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Electrical World

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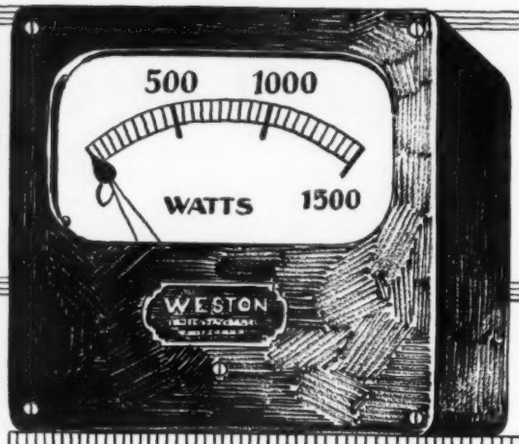
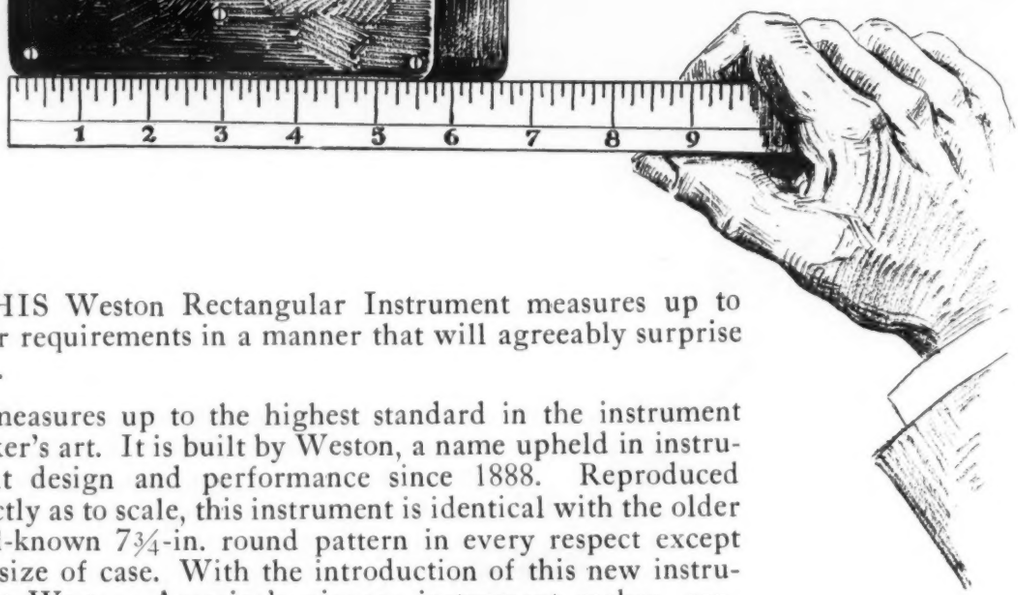


an Instrument made to Measure



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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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The Industry Seeks Investors and Not Speculators

WITH the securities of electric public utilities in such high favor, the tendency of the public, aided and abetted by brokers, to gamble in such issues is inevitable. The profits in some cases seem high and worth the chance. However, the reaction following losses is detrimental to the industry as a whole and outweighs years of work in building good public relations. The industry cannot, of course, curb the instincts of gamblers but it can warn its patrons and others against them.

The sales of stocks of public utilities in the stock exchange or curb markets is not large as a rule. In fact, an order for a few hundred shares would send the market skyward and the sale of a few hundred would have a diametrically opposite effect. Therefore every sale is subject to interpretation and analysis. By and large, every share of electric public utility stock is worth every cent paid for it and more. The exceptions are too few to notice, but with money cheap and stocks attractive the temptation to plunge is strong. Many companies have sold shares to customers and employees. What we wish to point out is that there is a moral obligation on the utilities' part to keep these people informed and protected against Wall Street sharks. The central-station industry wants these buyers and the public as a whole to invest and not to speculate in the securities of electric public utility companies. Ample information on every aspect of security purchases or proposed purchases is therefore the right of the investing public.

Wembley Has a Message for American Electrical Manufacturers

IF ANYTHING were needed to make it clear to American manufacturers of electrical products that foreign trade offers them a market of great promise, the World Power Conference at Wembley, London, has dramatically provided the evidence. For here more than thirty nations, representing all the progressive peoples of the world, gathered together to present their power problems and experiences and to consider plans for the extension of electric power development in the service of industry and the home. In short, the entire export market went to Wembley to discuss what to do, which, practically speaking, means what to buy. And all eyes seemed to be turned to America, because it is known that we have progressed further electrically than any other country.

Now is the time to develop the export market for American electrical equipment. Our products have a prestige today that is worldwide. In the fields of high-tension transmission and railway electrification, for instance, our leadership is unquestioned and our products sell without regard to price comparison. Our labor-saving domestic appliances have a most fortunate opportunity, both because these products of Yankee ingenuity are not manufactured abroad and also because today servants are not obtainable in Europe on the pre-war scale and the people are being compelled to change their habits of housekeeping and need these devices to lighten the burden of housework. Our wiring materials are built to higher standards of quality and cost than obtain in Europe and South America, and that is a serious obstacle; but there are many markets about the world that are offering business, and there is no reason anyway why American manufacturers cannot compete in selling the goods that the foreigner wants.

But we must take action now. Already certain European manufacturers are making strenuous efforts to sell high-voltage transmission equipment to American central-station companies, endeavoring at any cost to win, by selling to America, the prestige which we now enjoy so universally abroad. It is important, therefore, that we intrench ourselves in the export market while our position is so strong. It is important because this market offers to electrical manufacturers a profitable business already vast and yet just now only in the first stages of a very great development.

Public Service Commissions Versus the Federal Courts

THE Attorney-General of the State of New York in seeking support for the La Guardia bill brings forward no new argument. Like its predecessor, the Bacharach bill, the measure introduced by Congressman La Guardia of New York is designed to limit the jurisdiction of federal courts in rate cases. Just because the New York Telephone Company has successfully appealed to a federal judge in a case involving an increase in rates disallowed by the Public Service Commission, a hue and cry is set up against the authority of federal courts, notwithstanding that the increase granted by the court is both conditional and temporary. It is only on proof of the alleged losses that the company can keep what the court has allowed it, and the company is under bonds to repay the increase in case it proves not to be justified. This may give rise to ill feeling on the part of some people, but it certainly does not savor of injustice. The greater danger lies in undermining respect for law by such attacks as those of the Attorney-General of the state and the Corporation Counsel of the city.

Our system of jurisprudence is based on fundamental principles tested and sanctioned by long experience and is designed to promote public security. It cannot long survive if every man feels at liberty to repudiate obligations to obey any law which he regards as an excess of authority. Washington in his "Farewell Address" prophetically foretold such attacks in these words:

"Toward the preservation of your government and the permanence of your present happy state it is requisite not only that you steadily discountenance irregular opposition to its acknowledge authority, but that you also resist with care the spirit of innovation upon its principles, however specious the pretexts. One method of assault may be to effect in the forms of the Constitution alterations which will impair the energy of the system and thus to undermine what cannot be overthrown."

It has been well said that this is "a government of laws and not of men," and therefore to undermine the law is to undermine the government. Our federal courts are distinct from state public service commissions; the latter determine facts, the former interpret law, and in granting injunctions in rate cases federal judges do not, as the Attorney-General maintains, usurp rate-fixing authority.

Popular Fallacies Regarding Mouth-of-Mine Stations

THE proposal to establish near pit heads a number of superpower stations for electric supply has fired the imagination of laymen and newspaper writers both here and in England. Even engineers who ought to know better have succumbed to the suggestion. There is no doubt of the savings in generation of electricity made possible thereby; but the trouble is, and it is an insuperable one, that nature has rarely seen fit to put coal and water together. However, for every ton of coal burned under modern power-house boilers from 600 to 1,000 tons of water is required to condense the steam discharged from the turbines. That is why superpower stations must in the main be built on large rivers or at tidewater, and that is why the great interior cities of this country and of England are handicapped in the erection of superpower steam stations. Coal is usually obtainable, water is not; and modern stations require a thousand times more water than coal. As a matter of fact, the Waterside station in New York City pumps more water for condensing purposes than the whole city of New York consumes for all purposes, and the same is true of the Commonwealth Edison Company of Chicago and numerous other public utility companies possessing huge steam generating stations. A station at the coal mine is ideal, but, like many ideals, rarely works out in practice.

Superpower Studies in the Northeastern States

THE report on the superpower study made by a committee comprising engineers of public service commissions, appointees of governors and government engineers, under the general chairmanship of Herbert Hoover, has been issued by the government. It is an admirable document and will bear close study by the managers and engineers of electric public utility companies. That its general conclusions do not differ in the main from those of the United States Geological Survey, which made a similar study shortly after the war, adds to its reliability. It points out guiding principles for the development of power resources to provide continuously adequate power to meet the needs of the country's growth. There may be many good and controlling reasons why suggested interconnections and hydro and steam developments cannot be made. Monetary considerations and legal difficulties have always to be reckoned with in any grandiose plan like that proposed; but the movement is a step in the forward direction, and it is the duty of the industry to support it whole-heartedly. Interconnection is the order of the day, and the more minds are put to work on the immediate problem the more rapid will be the solution. Besides, it all redounds to the credit of the electrical industry, and to quote a well-known slogan: "Eventually—why not now?"

Superpower System of High-Voltage Networks

ONE of the striking features of recent discussion of superpower and extra-long-distance power transmission has been an apparent difference of opinion between Eastern and Western engineers as to the best operating conditions and the reliability of long lines. It will be recalled that for some time engineers from the Pacific Coast have maintained that the best conditions were as nearly as possible constant voltage over the whole system, equalization of voltage being obtained by synchronous condensers suitably placed. In other words, it is implied that constancy of voltage is the prime consideration, and that the synchronous condensers should be located to accomplish this voltage control, quite regardless of other considerations. Material confidence has been added to these opinions by accounts of increasing reliability of operation of existing lines as new substations are added. At the last midwinter convention of the A. I. E. E. several papers were presented analyzing the long-distance problem, and apparently considering it without reference to the inherent value of intermediate substations in effecting constant-voltage regulation.

It is, therefore, especially interesting to find these apparent divergent points of view approaching each other in the suggestion made in a paper by P. H. Thomas in the July *Journal of the A. I. E. E.* He visualizes the great advantages, from the standpoint of operation, in a combination of long-distance transmission lines and sufficient number of load centers lying even at considerable distances in different directions from the central sources of power. He proposes a high-voltage network in which several transmission lines are laid so as to connect a number of load centers, rather than to construct the shortest transmission lines between large power sources and heavy load centers having wide areas of distribution. By the interconnection proposed it is suggested that the high-voltage links need only be of one circuit each, and in this way the cost of the added length of high-voltage lines would often be brought below that which would pertain to multi-circuit trunk lines.

It is especially interesting to note that, in considering operating conditions, Mr. Thomas proposes the use of approximately constant voltage throughout the network, using if necessary synchronous condensers to accomplish it. It is also interesting to note that, in considering the Southern Appalachian system reviewed by him, he finds that owing to the capacity of the extended high-voltage system the requisite synchronous condenser capacity is extremely small. The paper also emphasizes many other advantages of the high-tension network, as, for example, the reduction of spare capacity,

the shifting of loads to meet variations in power supply, improved voltage regulation, and opportunity to develop favorable power projects to the exclusion of less favorable ones which may be nearer the load.

Other discussion of this character seems to indicate that the superpower system of the future will arise through interconnection of networks of the type described, leaving abnormally long trunk lines from distant sources of power until such time as an increasing expansion of load demands will bring such sources of power nearer to existing networks.

The Diplomats of Industry

REPRESENTATIVES of manufacturers in the electrical industry are no longer characterized by the term "traveling salesmen." They have honorably earned the title of "sales engineers" by their efficient service and wise counsel. In many ways they are the chief apostles of the service idea and have helped inculcate it throughout the length and breadth of the land.

These commercial engineers have two great assets to contribute to the upbuilding of the industry. They are sympathetic and human personalities with broad perspectives and diversified experiences which enable them to meet men on an intimate and sympathetic plane, and they are the liaison men between makers and users and because of this have the knowledge, contacts and viewpoints which enable them to act as diplomats to reconcile differences in opinions and practices. Possessed of "good common sense," a knowledge of psychology and field experience, they have been able to smooth out many troublesome problems mutual to makers and users without friction and with unobtrusive effectiveness. And they are more than diplomats—they are men of constructive ideas. They have an engineering background and a field contact and experience which they put to good service. They know why and when changes in equipment are desired by users and advisable for makers to introduce. They often and very unselfishly give constructive ideas to makers and users involving engineering and commercial practices or developments which are capitalized and used.

In every way the sales engineer has developed into an important and useful cog in the electrical machine. He deserves even greater credit than he now receives.

Electricity Makes Metal from Ore

IN THE production of metals from ores electricity has come into play very greatly because it eliminates steps in the processes and in general produces a purer and better metal. Its still greater use, however, depends on reducing the cost of electric power and in further developing processes. On a commercial basis the electrolytic action of electricity is used most extensively for low-grade copper ores running between 1 and 2 per cent copper. In some cases, notably at Ajo, Ariz., in Chile and in the Belgian Congo, very dissimilar ores are leached with acidulated water and the solution is then submitted to electrolysis. However, ammonia leaching with chemical precipitation of the ore is also used to produce copper in several localities.

At Milford, Conn., the first American plant to use electricity to make iron from ore is in operation. This semi-experimental installation uses iron-sulphide ore and produces iron tubes by electrical deposition of the metal on a rotating iron mandrel. It has been found possible to make electrolytically pure metallic zinc directly from zinc sulphate ore, and indications point to the possibility of producing nickel, tin and other metals directly from ores in the near future.

This wonderful development of the electrochemist is rapidly changing ore extraction from a wasteful heat-using process to one which permits of refinements, regeneration and the production of byproducts and also combines a better energy efficiency with the production of a purer metal. It is another positive evidence of the universality of the use of electricity for industrial purposes of every kind.

Relative Importance of Problems Confronting Central Stations

THE erection of a mammoth steam station requiring one pound or less of coal per kilowatt-hour would be a noteworthy accomplishment. Engineers have a right to aim at such a performance and to feel proud if the feat is actually achieved. However, such stations cost fortunes, and financing is still the uppermost problem confronting the electric light and power industry. When a person has the price of a new pair of shoes, they can readily be purchased; but lacking the price the old will have to be mended, and oftentimes mended shoes are more comfortable than new ones.

New stations must be built of necessity, but at the same time greater opportunities for economy are to be found in almost every electric light and power system. For example, there are numerous systems where if electricity were generated for nothing the ultimate consumer would still have to pay as much as 10 cents a kilowatt-hour, because of the investment in overhead circuits necessary to distribute the electricity to him. Thus in such a case the problems of distribution are the all-important ones and a saving there is of immediate advantage. Of course there are limitations—line losses there are, transformer losses there are, slow meters, in fact the unavoidable losses may approximate as much as 25 per cent, and yet there is considerable room for improvement with what is left.

Greater savings may be made by redesign of lines so as to use the present investment to maximum advantage than by the erection of the most efficient steam station ever built. Engineers may profitably and advantageously turn their attention to the problems of distribution, which, though they may not be as enticing or as spectacular, still in their ultimate results are of infinitely greater importance to the utility as a business. Any engineer almost can make a showing by the expenditure of large sums of money, and it is easier by far to build something new.

It requires engineering ability of a high order, however, to take what already is in existence and patch it so as to make it serviceable for many years more, and if that operation can be performed without the expenditure of much money, the achievement is ten times greater, albeit less striking to the eye, than the erection of a superpower station. Not that the latter should be ignored; but, as the scripture has it, "those ought ye to have done and not to leave the other undone."

Features of Pottsville Substation East Penn Electric Company

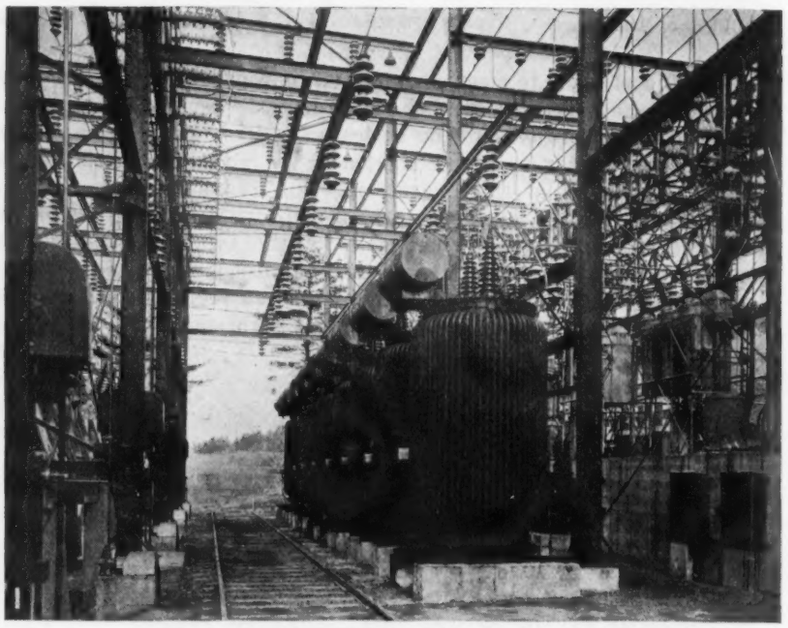
No. 1. Transformer aisle of step-down substation, showing nine 2,500-kva., single-phase, self-cooled transformers.

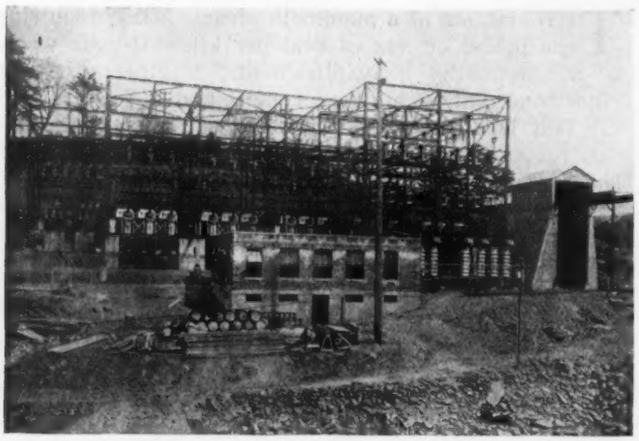
No. 2. General view of step-down substation at Pottsville, built in the hillside. Crane and repair house at right; operating building in foreground.

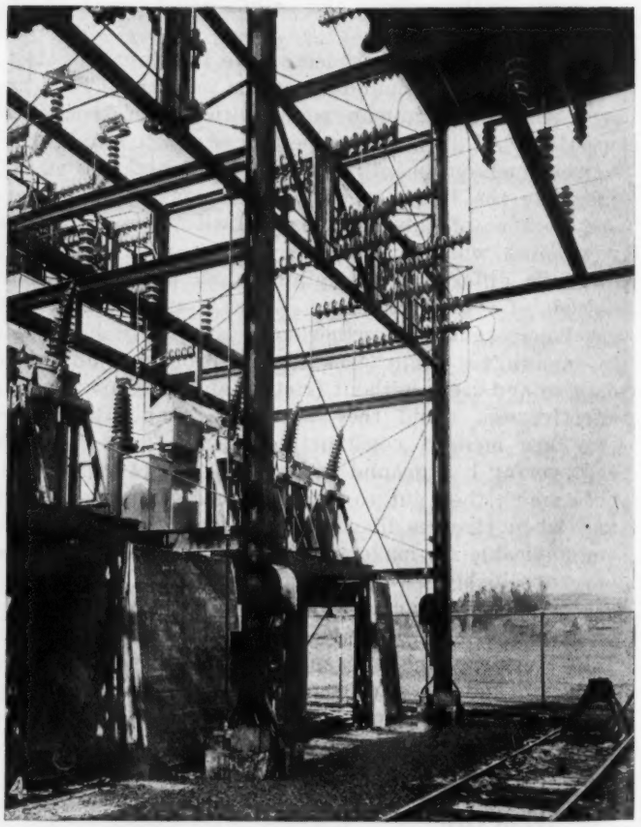
No. 3. 66,000-volt oil circuit breaker, current and potential transformers and potential fuses.

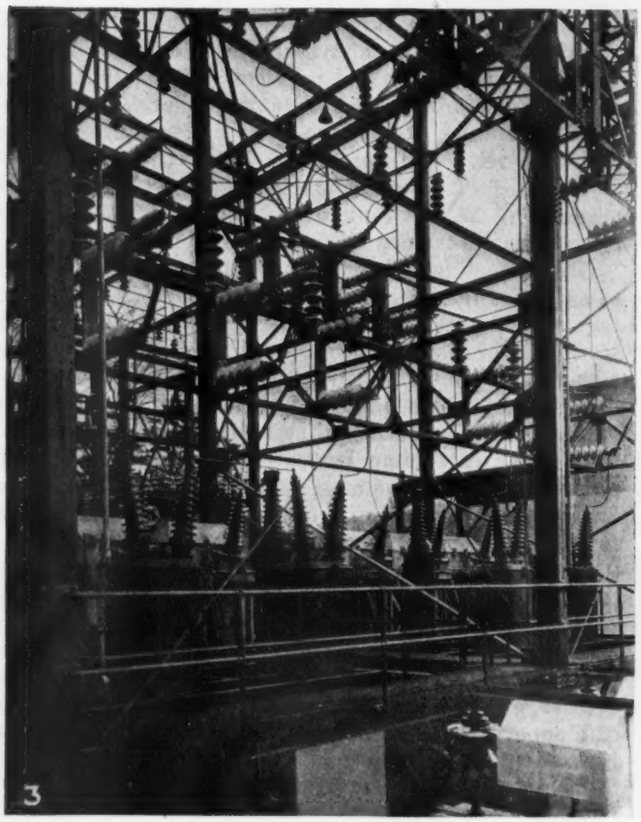
No. 4. New type of 66,000-volt motor-operated disconnecting swich.

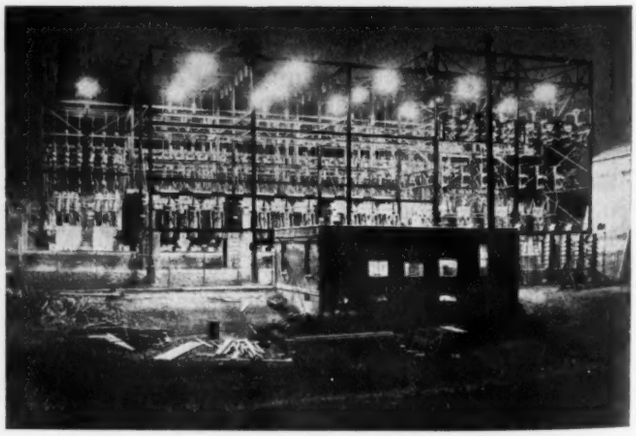
No. 5. Night view of Pottsville substation, showing good effect of overhead lighting.









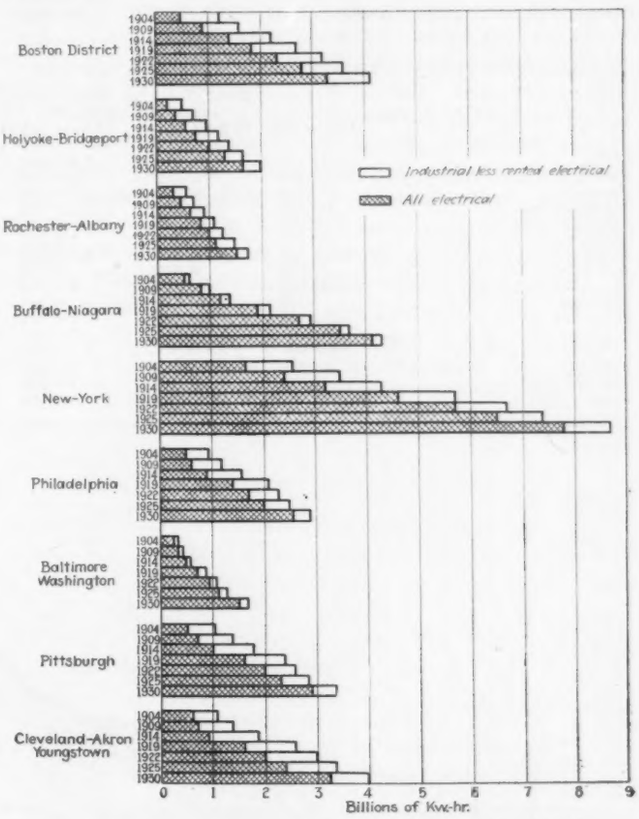


Northeast Power in 1930

Committee Estimates Demand for Electric Power Will Be 30.8 Billion Kilowatt-Hours in 1930 —Advocates Large Steam Stations and Development of Water Power—Statistical Data Compiled to Support Conclusions

IN OCTOBER, 1923, under the auspices of the Department of Commerce, a Northeastern superpower committee was formed, and later an engineering sub-committee was selected to inquire into the technical questions involved in power development in that territory. This technical sub-committee represented engineers appointed by the state commissions and engineers representing the Geological Survey, the Army, the Bureau of the Census and the Federal Power Commission. The report of this sub-committee has just been made available, and important abstracts are given in the following:

The area included in the study consists of the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia and some portions of Ohio, Virginia and West Virginia. In this area is concentrated 40 per cent of the country's population, and in it is consumed 50 per cent of the kilowatt-hour production of electrical energy and in it is operated 60 per cent of the primary power of the country. In 1922 there was produced 21.2 billion kilowatt-hours of electrical energy in this territory, of which 5.2 billion kilowatt-hours, or 25 per cent, was produced by water-driven generators. There is in addition approximately 13.9 billion kilowatt-hours of mechanical power used in industry, not including railroad transportation, which to some extent could be advantageously replaced by electrical power. A concerted development of electrical power would permit of the advantageous use of approximately 4.2 billion kilowatt-hours per year for railroad electrification. The distribution of this power among the states is indicated in Table I. The present power construction has its largest concentration centers in the districts indicated in Table II. A study of this table shows that about 84 per cent of the total electrical power is in these large centers of consumption. An approximation of the future demand, not including possible electrification of railways, indicates the total electrical power demand in 1930 will be 30.8 billion kilowatt-hours. The geographical distribution of this demand and estimated future demand by states is given in Table III.



POWER CONSUMPTION AT LOAD CENTERS 1904-1930

TABLE I—TOTAL PRODUCTION OF POWER IN 1922 AND ESTIMATED ELECTRICAL POWER NEEDED FOR RAILROAD ELECTRIFICATION

States	Production of Power—1922: Central Station, Electric Railways, Manufacturers. (Total Production.) Millions Kw.-Hr.	By Water-Driven Generators Only. Millions Kw.-Hr.	Per Cent of Power Produced From Water Power	Industrial Prime Mover Capacity Which Does Not Drive Generators, Hp.	Steam Railway Power Consumption if Electrified. Millions Kw.-Hr.
Maine	477	450	95	470,000	354
New Hampshire	262	217	83	210,000	189
Vermont	150	148	99	270,000	120
Massachusetts	2,274	450	20	1,210,000	235
Rhode Island	477	8	2	220,000	33
Connecticut	885	195	22	430,000	202
New York	7,934	3,160	50	1,790,000	1,210
New Jersey	1,531	0	0	920,000	283
Pennsylvania	6,210	620	10	3,750,000	1,420
Delaware	110	0	0	330,000	8
Maryland	553	5	1		196
District of Columbia	284	0	0		
Total	21,147	5,253	25	10,600,000	4,250
Virginia	718	250	35	320,000	920
West Virginia	1,444	29	2	280,000	744
Ohio	3,862	38	1	2,060,000	1,280

The electrical power is supplied from water and from coal, and the present developed water power is about 3,036,000 hp.; the total potential water power available 90 per cent of the time is 5,426,000 hp. This is increased to 7,914,000 hp. available 50 per cent of the time. The water power developed and undeveloped by states is given in Table IV. At present, about 38 per cent of the total water power ultimately available in this area has been developed. The practical rate of development of water power will probably be such that not more than 25 per cent of the total power demand in any year can be met from this source. Principal dependence must be placed upon the generation of power from coal.

There are in the area studied nearly 200 different utility companies engaged in power production and distribution, many under common ownership. Of these about 45 per cent are technically interconnected, but only about 8 per cent of the interconnections have capacity large enough for effective interchange of power. The economic generation and distribution of power vitally requires that it be produced in large plants.

TABLE II—LOCATION OF POWER CONSUMPTION

District	Kw.-Hr.
Metropolitan	5,700,000,000
Buffalo-Niagara	2,700,000,000
Boston	2,300,000,000
Pittsburgh	2,000,000,000
Philadelphia	1,700,000,000
Baltimore-Washington	1,350,000,000
Holyoke-Bridgeport	1,000,000,000
Albany-Rochester	1,000,000,000
Total	17,750,000,000
Cleveland-Akron-Youngstown district	2,000,000,000

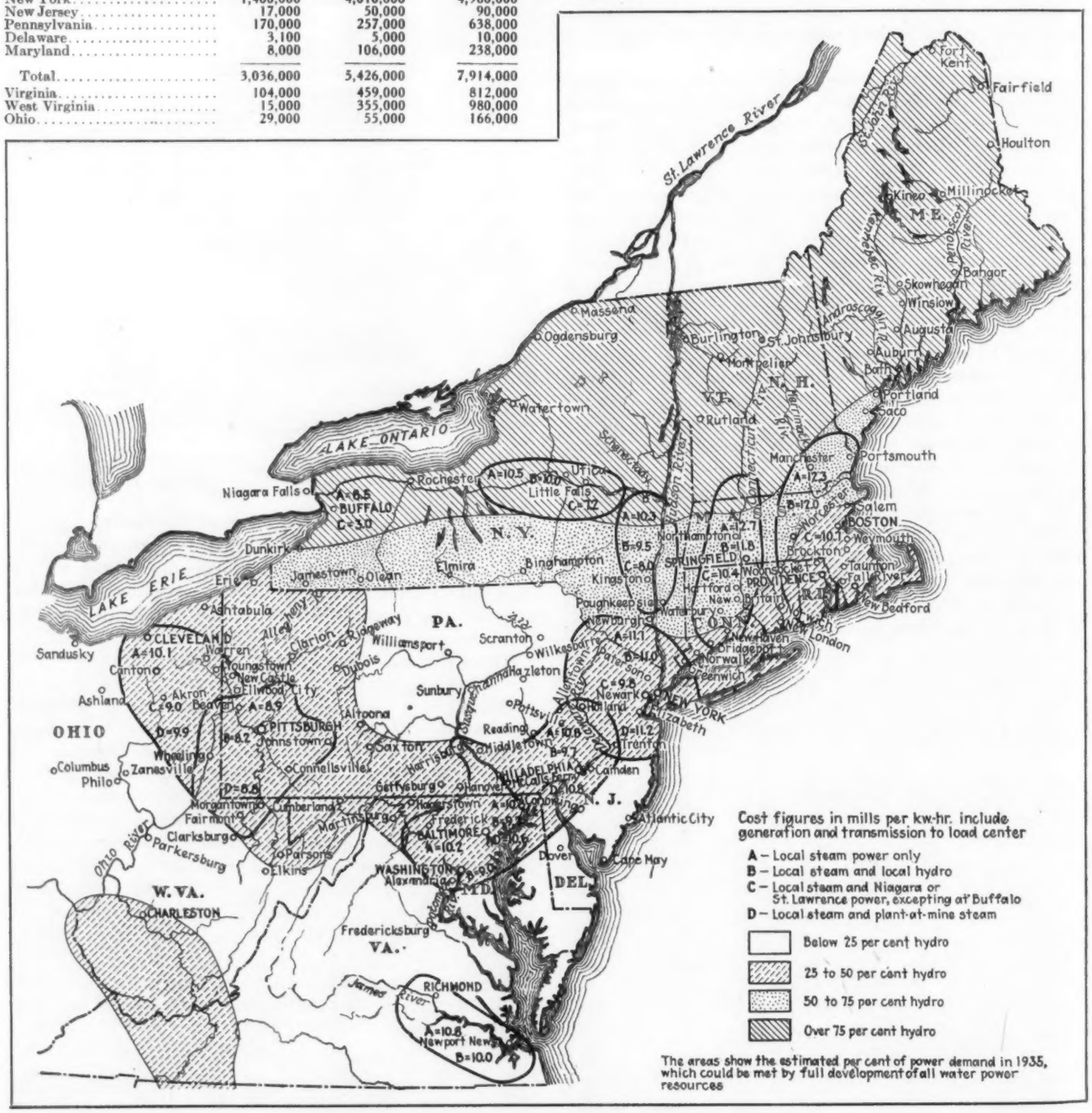
TABLE III—PRESENT PRODUCTION AND FUTURE DEMAND FOR ELECTRICAL POWER

States	Produced in 1922* Millions Kw.-Hr.	Estimated Demand 1930 (Not Including Electrification of Railroads). Millions Kw.-Hr
Maine	477	585
New Hampshire	262	272
Vermont	150	180
Massachusetts	2,274	2,800
Rhode Island	477	677
Connecticut	885	1,380
New York	7,934	10,800
New Jersey	1,531	5,000
Pennsylvania	6,210	7,850
Delaware	110	.....
Maryland	553	1,330
District of Columbia	284	.....
Total	21,147	30,874
Virginia	718	1,360
West Virginia	1,444	2,080
Ohio	3,862	5,000

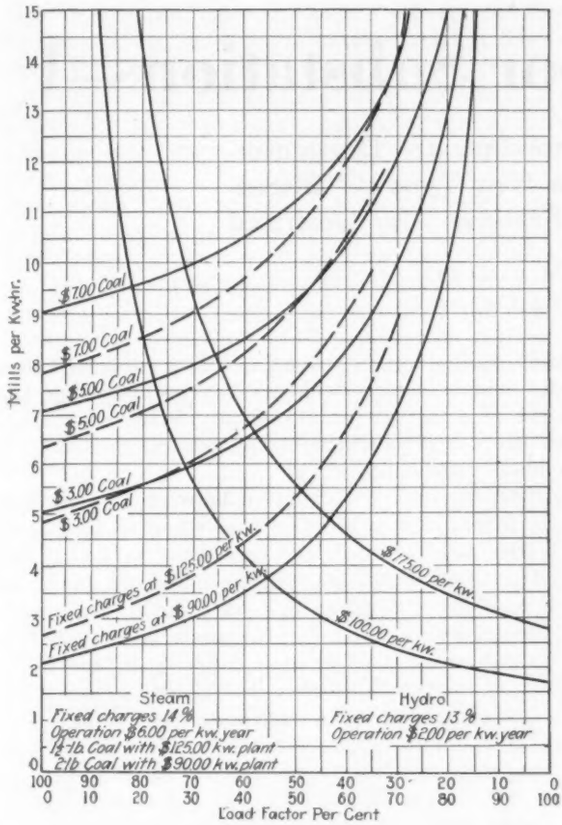
* Includes electrical power produced by central stations, electric railways, and in isolated plants.

TABLE IV—WATER POWER DEVELOPED AND UNDEVELOPED

State	Developed Hp.	Total Potential Horse Power (Including Developed). 90 per Cent of Time Flow	50 per Cent of Time Flow
Maine	478,600	536,000	1,074,000
New Hampshire	261,300	186,000	350,000
Vermont	175,400	80,000	169,000
Massachusetts	357,000	106,000	235,000
Rhode Island	30,300	25,000	40,000
Connecticut	134,700	65,000	110,000
New York	1,400,000	4,010,000	4,960,000
New Jersey	17,000	50,000	90,000
Pennsylvania	170,000	257,000	638,000
Delaware	3,100	5,000	10,000
Maryland	8,000	106,000	238,000
Total	3,036,000	5,426,000	7,914,000
Virginia	104,000	459,000	812,000
West Virginia	15,000	355,000	980,000
Ohio	29,000	55,000	166,000



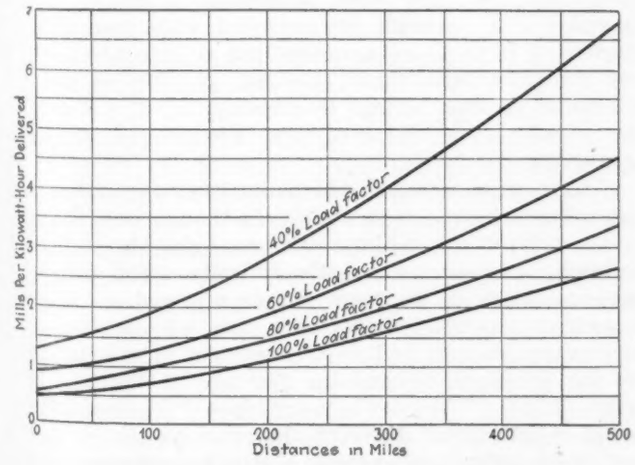
COMPARISON OF COSTS OF POWER FROM VARIOUS SOURCES



PRODUCTION COSTS AS BASED ON RECENT PRACTICE AND EXPERIENCE OF LARGE OPERATING COMPANIES

TABLE V—FREIGHT RATES AFFECTING STEAM POWER PRODUCTION COSTS

To	From Fairmont District	From Pocahontas District	From Clearfield, Pa.
Boston, Mass.	$4.00	....	$3.77
Fall River, Mass.	4.23	....	4.00
New York, N. Y.	3.10	....	2.88
Philadelphia, Pa.	2.76	$4.28	2.53
Baltimore, Md.	2.76	3.93	2.53
Washington, D. C.	2.76	4.05	2.53
Richmond, Va.	3.54	2.65	3.43
Harrisburg, Pa.	2.30	3.15	2.08
Pittsburgh, Pa.	1.39	2.87	2.20
Cleveland, Ohio	1.99	2.64	2.44
Buffalo, N. Y.	2.58	3.48	2.48
Syracuse, N. Y.	....	....	2.64
Norfolk, Va.	....	2.65	....
Perth Amboy, N. J.	3.07	....	....



TRANSMISSION COST BASED ON 75 PER CENT CAPACITY FACTOR

Present practice indicates that such plants should be constructed with total capacities of from 200,000 kw. to 500,000 kw., using generators of not less than 20,000 kw. each.

Water supply dominates the location of these plants, and a study of the territory, in conjunction with other facts, indicates that these plants must be restricted to locations at the seaboard, the Great Lakes, the Ohio River and its tributaries and the Susquehanna River. The large use of steam in this territory renders possible the use of seasonal flow of rivers for relief of steam, and more complete utilization of rivers than in any other part of the United States. Interconnection in this area in some cases will convert secondary hydro power into primary power, and in other cases will enable daily peak loads to be carried on hydro. The great water powers capable of expansion are: Niagara River, St. Lawrence River, Delaware River, Susquehanna River, tributaries of the upper Ohio, Adirondack powers, Potomac River and State of Maine rivers.

The accompanying chart and map show the cost of power as determined by the engineering sub-committee, and these costs were based on the following:

Steam Power Production Costs	
1. Construction cost of new modern high-pressure plants per kilowatt	$125.00
2. Construction cost for average steam plant now producing power at large load centers per kilowatt	$90.00
3. Fixed charges, per cent	14
4. Operation and maintenance per kilowatt-year demand	$6.00
5. Coal consumption of modern plant per kilowatt-hour, lb.	1½
6. Coal consumption for older plants per kilowatt-hour, lb.	2
7. Price of coal at the mine per 2,000 lb.	$2.50
8. Freight and handling charge for plant at mine per 2,000 lb.	$0.50
9. Storage, handling and insurance at large load center per 2,000 lb.	$0.30
10. Freight rates per ton of 2,000 lb.	As given in Table V
Water Power Production Costs	
1. St. Lawrence and Niagara Power construction costs per kilowatt installed	$100.00
2. Local hydro-plant construction costs per kilowatt installed	$175.00
3. Fixed charges per annum, per cent	13
4. Operation and maintenance per kilowatt-year	$2.00
Transmission—In Units of Two Circuits	
1. Annual capacity factor (one spare in every four), per cent	75
2. Annual load factor, per cent	70
3. Voltage	220,000
4. Capacity per circuit, kw.	150,000
5. Cost of line per circuit per mile	$17,000.00
6. Rights-of-way per mile for two circuits	$5,000.00
7. High-tension substation at power house at $5.50 per kilowatt per circuit	$825,000.00
8. Substation cost at $12 per kilowatt per circuit	$1,800,000.00
9. Condenser cost per circuit per mile—$7 per kilowatt—capacity 0.002 kw. per kilowatt-mile	$2,100.00
10. Switching stations to divide the two circuits into sections not to exceed 100 miles in length, per station	$250,000.00
11. Two circuit telephone lines per mile for two circuits	$1,200.00
12. Let n = number of miles, and m = number of switching stations. Cost per kilowatt capacity = $[825{,}000 + 1{,}800{,}000 + n(17{,}000 + 5{,}000 \div 2) + 2{,}100 + (1{,}200 \div 2) + (250{,}000m \div 2)] \div (150{,}000 \times 0.75) = \$23.33 + 0.197n + 1.11m$.	
13. Transmission losses: 100 miles = 8 per cent; 200 miles = 10 per cent; 300 miles = 13 per cent; 400 miles = 17 per cent; 500 miles = 21 per cent.	

The economical and adequate power supply for this area requires the extension of interconnection between different systems, the building of large centralized steam electric plants located at strategic points and the development of the large hydro-electric projects.

The economic values of these developments will result in an estimated reduction of coal consumption by more than 50,000,000 tons annually, the more economical production of power, the security of power against interruption, larger reserves of power, electrification of transportation, extension of power use to the farm and a decrease in human labor.

New Types of Outdoor Substations—I

Structural Details—Use of Motor-Operated Disconnecting Switches—Description of a New Type of "Disconnect"—Lighting and Control Features Also Described

By C. D. GRAY and M. M. SAMUELS
The J. G. White Engineering Corporation

THE rapid development of electrical apparatus of many kinds—such, for instance, as transformers, oil circuit breakers, lightning arresters and disconnecting switches—in recent years has produced entirely new types of outdoor substations, and the recent tendency to eliminate generator buses and to make the transformer a continuation of the generator, doing all the switching on the high-tension side, causes still greater importance to attach to the design of outdoor substations.

It may at once be seen that there will be a natural distinction between two types of substations, the step-up substation at the power house and the step-down substation at the other end of the transmission line. The transformer of the step-up station, being a continuation of the generator, should logically be a three-phase unit, since there is no real reason for spending a great deal of money on spare transformer capacity in excess of turbine unit capacity, the possibility of trouble on a transformer being less than on a turbine unit. From the point of view of economical operation, the unit size is really determined by the turbine, so that there can be no argument from this source in favor of smaller transformer units. Near a large power house, where good water is generally available and competent supervision easily obtainable, water-cooled transformers are quite satisfactory, though it is true that when very large units come to be used in the future, such as 40,000 kva. and over, it may be preferable to go to a forced oil system which will circulate the oil through cooling coils inserted in a water system outside the transformer tanks. With the latter method there will be a further advantage in the possibility of operating when needed a permanently connected centrifugal oil purifier in the oil-circulating system.

WATER-COOLED TRANSFORMERS REDUCE INITIAL COST

Thus it is possible to obtain in the step-up substation a saving of 20 per cent to 30 per cent in the first cost of the transformers by using three-phase water-cooled units, without in the least affecting the safety and efficiency of the station. In the step-down substation, however, the size of the transformers will be determined by load fluctuations at the particular substation, and they will generally be smaller than at the step-up substation. Furthermore, the transformers in the step-down substation being the primary energy supply, spare units must be provided, and it will generally be found advantageous to use single-phase units for this reason as well as for the further reason that whereas facilities for handling large transformers are always available near the site of the power house, they are not so available near a step-down substation. The water problem will likewise offer considerable difficulty, it being either unavailable or at best very expensive, possibly calling for the use of a cooling pond with spray nozzles which is unreliable where the operating force consists of only one or two men. Self-cooled single-phase units are therefore being generally used in the step-down substation.

Another important distinction between the two types of substations lies in the fact that whereas the step-up substation will have very few circuits of large capacity, consisting principally of transformers and main outgoing line circuits, there will have to be provided in the step-down station a considerable number of distribution circuits of smaller capacity in addition to the transformer and incoming-line circuits.

By far the most important distinction between the two types is the fact that whereas the step-down station can be erected on almost any available site, the step-up station must be as close to the power house as possible in order to make the main copper runs from generator to transformer as short as possible and to allow for supervision by the power-house force, but at the same time it must be kept a safe distance from any existing cooling ponds or coal-handling equipment.

FUNDAMENTAL-DESIGN PRINCIPLES

The designs of both types of stations, though different in many respects, will have to be based on the principles of simplicity, compactness and safety. These principles must be borne in mind not only as regards the arrangement of apparatus and its interconnections but likewise in the design of the steelwork. The columns should be as simple as possible, using only ordinary members such as H sections or, possibly, expanded poles, and the horizontal members should likewise be single beams, channels or angles with sufficient strength to support not only the apparatus but a rigging crew and rigging equipment. Lattice poles should only be used when absolutely necessary, and diagonal braces should be employed with discretion, since even if they are arranged not to interfere with any clearance requirement, they may so interfere when a change in the wiring is required in the future, the result being awkward and complicated wiring arrangements.

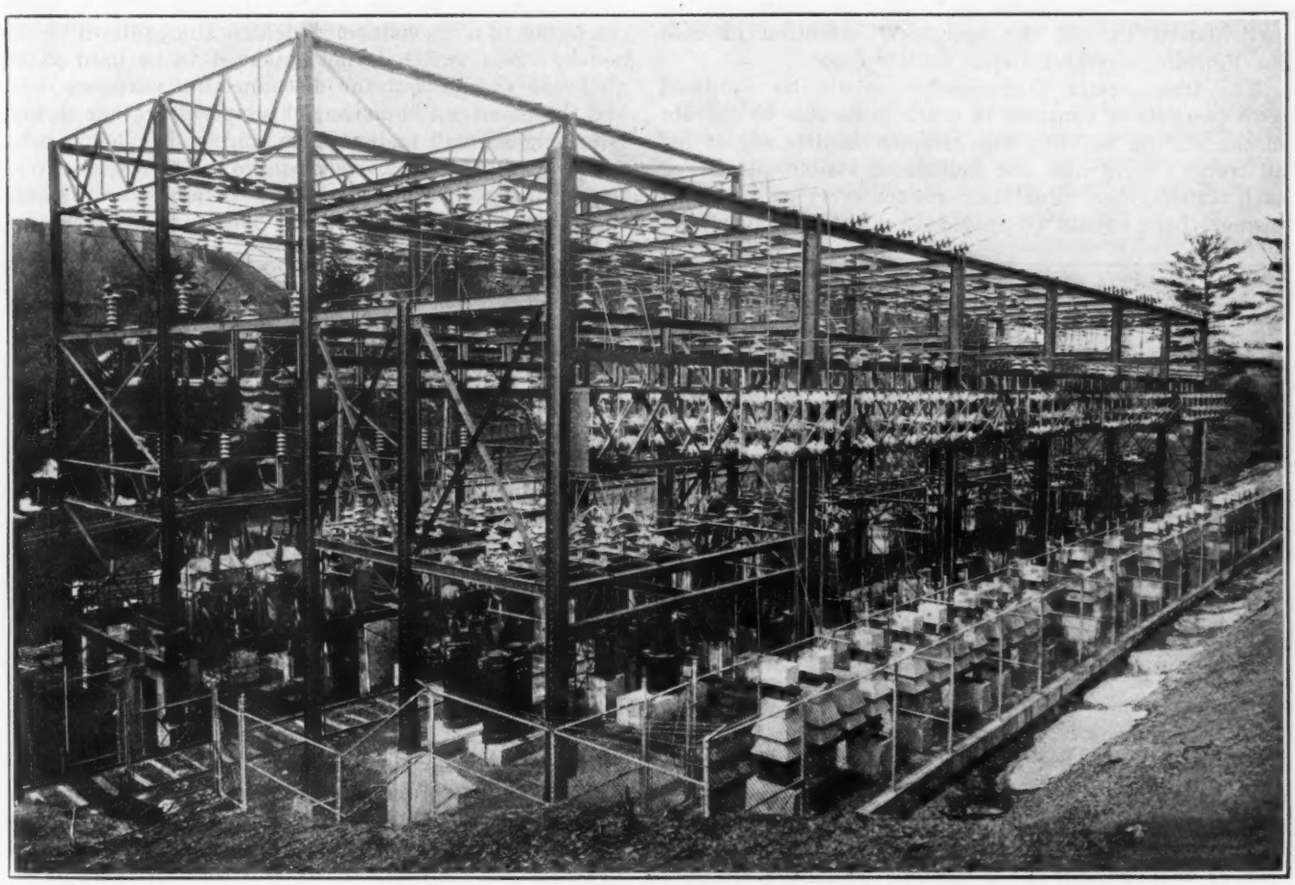
Transformers, oil circuit breakers, lightning arresters and other principal apparatus, even though continually changed, developed and improved upon, give the station-designing engineer very little difficulty. The disconnecting switch is his main source of trouble. Even though of secondary importance, the type of disconnecting switch used and its arrangement in the station are the principal determining features of the station arrangement. There are so many types of disconnecting switches of entirely different character on the market that it is difficult to express a strong preference for any one particular type. A great deal of confusion

exists in the disconnecting-switch market, so that for the same voltage one manufacturer may furnish insulators having only half the flashover value of those furnished by another manufacturer. There is a great variety in break distance, blade length and copper thickness, aside from the fact that many designs on the market now may be designated as mechanically unsound. Great discretion is therefore necessary before deciding on disconnecting switches for a large development.

The stick-operated disconnecting switches are now a thing of the past in large outdoor substations, the gang-operated switches having taken their place, and very recently the motor-operated disconnecting switches have been coming more and more into general use not only as disconnecting switches but likewise as bus selector switches. Even though only a comparatively new development, the motor-operated disconnecting switch appears on the market in many types, very few of which, if any at all, can be considered entirely satisfactory. The greatest fault seems to be not so much in the principal ideas underlying the designs of the various types of switches and mechanism as in the details. The motor mechanisms, particularly, appear to be amateurish in most cases, and another error which many manufacturers are committing is that, instead of designing a switch and mechanism as a unit, they are attempting to adopt mechanisms to the old type of stick-operated switch, consisting of two insulators and a hinged blade, introducing for this purpose many clumsy links and levers and insulators in awkward positions, which make the whole arrangement appear as a very clumsy piece of apparatus.

Insulators for use in high-tension substations should be selected with due regard to transmission-line insulation. The insulators in the station should have a higher flashover value than those on the line, otherwise all "spillovers" would have a tendency to occur on the station bus. The same insulator should preferably be used on bus supports, switches, fuses, etc., to allow for interchangeability.

Current transformers should always be placed on the protected side of the oil circuit breaker, and potential transformers should be eliminated as much as possible and, when absolutely necessary for line-synchronizing purposes, should be protected by good fuses, not so much to protect the potential transformer as to protect the system from the potential transformer. The fuse should either be of the disconnecting-switch type or should have a separate disconnecting switch in series with it.



VIEW OF UPPER PORTION OF POTTSVILLE STEP-DOWN SUBSTATION, SHOWING 24,000-VOLT OUTGOING CIRCUITS

Each large lightning arrester should likewise be equipped with a gang-operated disconnecting switch and should be completely surrounded by a separate wire fence, even when installed within the station fence line, since during a discharge the lower parts of the arrester, exposed to accidental contact with a passerby, may be alive.

Each large transformer, oil circuit breaker, lightning arrester, etc., should be equipped with a red and green indicating lamp to show whether or not the apparatus is energized. The high-tension and low-tension transformer circuit breakers, or the high-tension circuit breaker and low-tension disconnecting switch in the case of a generator main transformer, should be each equipped with two single-pole, single-throw auxiliary switches, one to be closed when the oil

circuit breaker or disconnecting switch is closed (a) and the other to be closed when the oil circuit breaker or disconnecting switch is open (b). The two "a" auxiliary switches should be connected in parallel and operate a red light on the transformer, the two "b" auxiliary switches should be connected in series and operate a green light on the transformer. Similarly, the red and green lights on the oil circuit breakers can be operated by means of auxiliary switches on the disconnecting switches placed on each side of the oil circuit breaker. Similar auxiliary switches should be provided on the lightning-arrester disconnecting switch to operate red and green lamps at the gate leading into the lightning-arrester inclosure, and parallel to these lamps there should be a pair of lamps on the switchboard to call the operators' attention in case the lightning-arrester switch be left open.

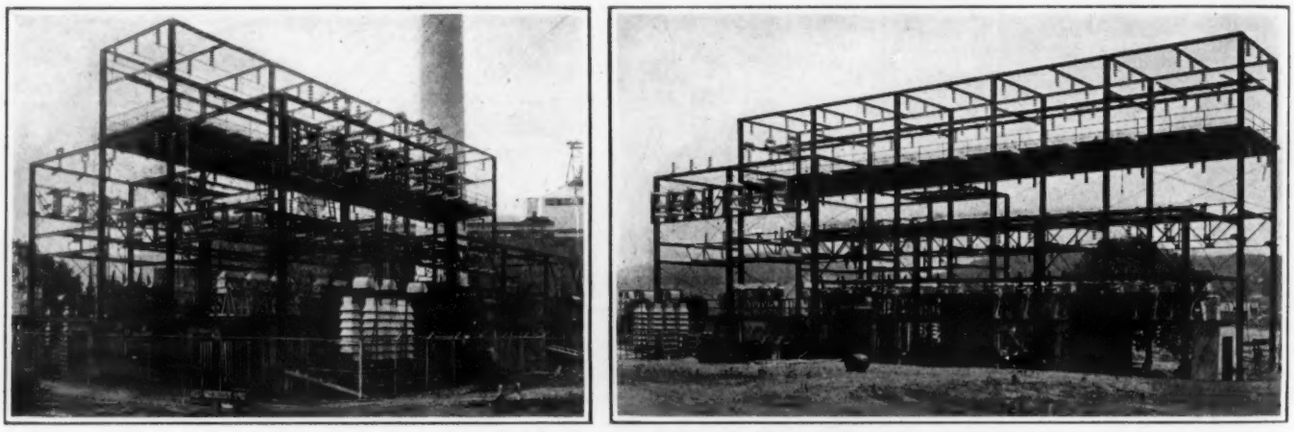
The transformer thermometer should be equipped with two sets of contacts in order to be able to operate in the station building one common audible signal for all transformers and one individual visible signal for each transformer. Furthermore, for every large transformer there should be provided on the switchboard a temperature indicator similar to the instrument used with generators.

It is very important to provide adequate lighting in all outdoor substations, and since floodlighting cannot be very well considered for stations which are compact and are pretty well filled with equipment, the problem requires some skill. The best method seems to consist in supplying as much of the illumination as possible from overhead steel reflectors with large units. An ample number of receptacle outlets should likewise be provided for portable purposes.

The step-up substation at Pine Grove, Pa., and the step-down substation at Pottsville, Pa. (Fischbach), of the East Penn Electric Company may serve to illustrate the two principal types of substations discussed above, with their distinguishing as well as common features, and also many new design features which may appear at first hand to be radical, but which were determined in each case by the nature of the individual problem and which represent in each case either a simplification or an improvement or both.

Excepting only the lightning-arrester "disconnects," all of the disconnecting switches in both stations are motor-operated, and in this respect the two stations are probably the first of their kind. A new type of disconnecting switch used on all the 66,000-volt circuits represents a unit design of a mechanism-operated switch, instead of a mechanism adapted to a switch. Each single-pole element has two stationary insulators, one over the other, in horizontal position, each mounted on a gear box on a common steel base. A vertical screw between the two gear boxes carries a movable insulator, the lower side of which is connected to the lower fixed insulator by a flexible copper cable supported on a steel grasshopper-like link, the upper part carrying a short vertical blade. The upper fixed insulator carries the contact box, open at the bottom only. The three movable insulators of a three-phase switch are furthermore connected by a spacing bar. Either the three upper or the three lower gear boxes are connected by a shaft which extends to the nearest column and is there connected to a mechanism which continues down to the motor. This switch is not intended to be used as an air-break switch, but for disconnecting purposes only, and therefore can be arranged to operate rather slowly, requiring a small motor. The contact box being open at the bottom only, it is sleet-proof. The switch offers the advantage of simplicity and naturalness and is easy to design and easy to mount. The auxiliary switches are mounted on station columns near the motor mechanisms, to allow for inspection and adjustment.

All insulators in both stations are Jeffery-Dewitt post type, one unit post being used to carry the 12,000-volt bars near the main transformers, two unit posts on all 24,000-volt switches and bus work, and five unit posts on all 66,000-volt switches and bus work, so that only single-unit posts have to be kept in stock to take care of replacements on all voltages. All of the above-described design and safety features were incorporated in both stations. Further details of each of these substations will be given next week.



GENERAL VIEWS OF PINE GROVE STEP-UP SUBSTATION

Canada Leads the World in per Capita Use of Electricity

STATISTICS just compiled by the Dominion of Canada's Bureau of Statistics show that Canada leads the world in the per capita consumption of electric energy. Each inhabitant consumes 820 kw.-hr. of electrical energy in a year. There is an electric meter installed in Canada for every five inhabitants and 454 hp. is installed for every 1,000 population. The present recorded water-power resources of Canada will permit of a turbine installation of 41,700,000 hp., of which today only 3,250,000 is installed.

World Power Conference Notes—II

The Final Week Devoted Primarily to Technical Subjects—No Permanent Organization Formed but Subsequent Conferences Predicted—Specific Resolutions of Policy Avoided

A Letter from **HAROLD V. BOZELL**
Editor ELECTRICAL WORLD

LONDON, ENGLAND, July 15, 1924.

THE first World Power Conference is now a matter of history. And if the proximity of the event has not warped the judgment of those in attendance, it has accomplished something of permanent value in the power industry and in the relations of the engineers of the different nations. Last week I said that some thirty-eight countries were represented—this week shows that there were forty-one. Instead of over 300 papers, there were more than 400. It will take weeks for any one to absorb all that was presented here—those who tried to get much of it even here in attendance soon got brain fag and decided to take the opportunity to make acquaintances and follow up specific inquiries and to try to find time later to study the papers and what record of the discussion has been made. This does not mean that meetings were not attended—it means that not many persons tried to absorb the entire convention. There was very lively discussion at many of the sessions and keen interest.

Essentially, the measure of the conference is not changed from what was indicated in last week's letter—the principle accomplished has been to gather together and exchange the information of experiences and practices in the various countries. There have developed a few new things—and each person has, individually, learned something he himself did not know before. Those in attendance will go home and make practical use of what they learned, while, in addition to the specific facts found out in this way, there has also been an inspiration instilled into each one, an increased desire aroused to go back and approach the problems of power development with renewed vigor. The exchange of experience and information has given a sense of security to many of the countries which they did not have.

UNITED STATES HAS GREATER OPPORTUNITY TO GATHER INFORMATION

It is with no sense of boasting on the part of the Americans to say that by far the larger part of information and experience has come from the United States. This fact has been pointed out many times by many speakers at the conference. The United States has had the opportunity to face a larger number of problems and it has had the resources and the initiative to solve them. The people of the United States may be very thankful that the system of private initiative and enterprise has been in vogue there, for they are gathering the benefits of that system.

The conference did not attempt to make or draw any specific conclusions on policy of power development as a result of the discussions which have taken place. The one significant conclusion which it did draw is as follows:

Resolved: That this conference is of the opinion that the world's most crying need today is greater production and manufacturing activity among its peoples under conditions which will promote individual prosperity and happiness, and that this can be largely achieved by the fuller development of national power resources and by the establishment of the most economical means for the general distribution and utilization of energy.

With reference to further work of a similar nature—that is, the possible continuation of the conference organization and the formation of a permanent organization international in nature—the conference decided not to try to create any permanent organization. It did, in fact, in the session on standardization, recommend that there be no attempt to create any other body to consider the question of standards in view of the existing International Electrotechnical Commission, which is the result of careful work over a period of many years. But it did seem to be the sense of the delegates in attendance that there should be subsequent world power conferences whose nature must be determined to fit the needs of the time and whose dates should be such as would naturally develop.

POWER TRANSMISSION AND DISTRIBUTION SESSIONS

The technical sessions of the week brought forth many matters of interest. There were three sessions devoted to various phases of power transmission and distribution—in all, fifty papers were scheduled for these three sessions. Quite frequently questions of policy seemed to displace the technical discussion. For instance, in discussion of the plan for the transmission of power from Sweden to Denmark, already described in these pages (see ELECTRICAL WORLD, Nov. 10, 1923, page 963), there was a definite crystallization of sentiment that whenever a country has a surplus of power it is to its best interests, and it therefore should be willing and anxious, to allow the export of that power to other countries without duties and free of charges arising from the fact that it is being exported—so long as any surplus exists.

Several of the papers had to do with superpower systems or plans for extensive distribution of power. D. B. Rushmore, United States, said that superpower should be considered from other angles than the purely technical. All phenomena are specific examples of general laws. In this case the general law is that the initial growth is by small units, these units into large units and finally these are tied together in larger or grand units which operate more efficiently and for the greater good. The electrical power industry was not therefore trying to introduce something on which there was no experience, but was foresighted enough to see that its growth and development was along lines that had been proved to be for the best common good. It is a rapid development and therefore spectacular—this growth of the superpower idea—but that is necessary on account of the rapid growth of the industry itself.

In the discussion C. H. Merz of Merz & McClellan, England, pointed out the great desirability, if not the necessity, of simplification of the entire transmission and distribution plant. It is not only the question of transformers at each of the successive step-up transformations and then each of the step-down transformations, but at each such point auxiliary equipment is used—and all this seems to be the predominating item in the cost of the complete plant. More reliable high-voltage transformers and high-voltage cables, so that the high-voltage system could come closer to the ultimate consumer, would help this situation, he pointed out. But the almost necessary buying on a price basis largely negatives efforts in this direction, and this is even more apparent in government enterprises. In support of this argument for quality and simplicity, the Swedish delegation pointed to Sweden's success in reducing the total cost of its installations by putting in the "best insulation anywhere used," and otherwise paying for quality where quality counted, by simplifying by leaving out protective gear, using a single line on wooden poles, etc., and using graded insulation to insure adequate dependability. There was also a plea for getting at the real center of the arc breaking problem and the construction of circuit breakers based on the principle of extinguishing the arc at its inception and not based on the admission that there must be an explosion, and that the thing to do is to control the explosion and not let it do too much damage. Mr. Merz said that he felt the adoption of ironclad switchgear was a great step forward, both in simplicity and in dependability. While the gear itself may cost more than open bus work, the over-all cost, including building (which is much smaller in the case of ironclad gear) is about the same for both and in some cases less for the ironclad gear.

PROTECTIVE EQUIPMENT ABANDONED IN SWEDEN

W. Borgquist of Sweden pointed out that Sweden found it necessary to build cheaply in order to save money, and that this has proved to its advantage. The plant was made simple, the amount of protection reduced to a minimum, single lines on wooden poles were used, and in every case, the mechanical strength was accommodated to the economic importance of the structure under consideration. During the last ten years the Swedes have abandoned lightning arresters, choke coils, etc., and there has been no trouble; on the contrary, the system has worked better. In one regard Swedish practice is not to save money; this is in connection with the electrical and mechanical strength of generators, prime movers, etc. As a result the record shows only one fault in forty generator years and one fault in every thirty-two to forty transformer years. The abandonment of lightning arresters has led to the use of graded insulation; that is, insulators have less strength than bushings, which in turn have less strength than the transformer windings, and so forth up to the generator.

One of the representatives from South Africa, in discussing Mr. Merz's statements, said that at the 6,000-ft. altitude of that country and with the frequent lightning and high winds experienced the duties imposed on switchgear were very onerous and that experience gained there supported Mr. Merz's conclusions. South African engineers believe that the circuit breaker is one piece of apparatus which has not been developed sufficiently from basic considerations. Experience seems to show that its development is going the wrong way, resulting merely in stronger cases rather than going at the fundamental problem.

AUTOMATIC STATIONS VERY RELIABLE

H. R. Summerhayes of the United States pointed to the increased use of automatic stations, which are now considered more reliable than those with human operators. With reference to cooling media for electrical machinery, experiments with hydrogen showed that corona formed at a lower voltage than with air, but that the fire risk is less with a completely closed system. In discussing the small use of voltage regulators in large steam plants he pointed out that in hydro-electric practice the failure of one line usually makes a great deal of difference in the behavior of other lines, but that in steam plants with a large number of small feeders any one failure affects the others little. Indications are, however, that the voltage regulator will aid the stability of operation in interconnected systems.

Guido Semenza of Italy said that most of the papers presented had told of how well things had been done, whereas he felt that the most constructive thing to do was to criticise the faults and to analyze the troubles. Bad service in general is considered bad from the customer's viewpoint, but it is also bad for the producer.

F. A. Gaby, Canada, said he did not agree with Mr. Merz that capital cost should be reduced in designing plants, but thought it was necessary to prepare for enormous stresses and that the plant must be designed with that in view.

WIDE INTEREST SHOWN IN CABLE DEVELOPMENT

The papers on cables attracted both attention and discussion. On the part of European cable manufacturers, there appears to be a feeling that American purchasers are always too much in a hurry for production and want the cables at too low a price and have imposed those conditions on American manufacturers. The European manufacturer is ready to assure 132-kv. single-core conductor when needed—to take orders for them now, however—and will supply at any time now 60-kv. or 66-kv. cables, but only on condition that he be allowed to install them. On that he insists.

The discussion on cables was opened by G. L. Addenbrooke, who said that, judging from his forty years' experience, all troubles seem to come down to the dielectric. To analyze the actions in dielectrics subject to electric stresses, Mr. Addenbrooke said, was the most important line of research. Practically it comes down to a charged condenser. Energy is stored up in the dielectric, and this must be reduced in analysis to the actual effect on the atom. The charge has a tendency to pull the atom out of shape and it springs back when the charge is removed. That analysis is all right for mica and paraffin, but in other dielectrics losses are carried on up and these losses are the real reason for breakdown. If the losses occur within the atom the only salvation is in the proper discovery and selection of material whose loss of this nature is a minimum, but if the losses are not within the atom, then they must be due to some extraneous matter, and there is therefore some hope of getting at the bottom of the question. Results today all point to there being a small percentage of electrolyte, usually water. If moisture does exist, it does not exist in its ordinary state, but in very small quantities and as ions. Some new dielectric is needed which will keep the moisture out.

Mr. Taylor called attention to the statement that the

limit of cable practice will be reached at 100,000 volts. He said that he felt that cables built upon the maximum-gradient theory could exceed that voltage and still retain practicable sizes.

L. B. Atkinson said that the maximum-potential theory was generally accepted today for alternating-current cables. It is not true with direct-current cables because the leakage of current changes the potential gradient, core to outer layer, to an *IR* straight-line gradient. But while all indications are that in alternating-current cables the maximum-potential gradient theory holds, yet the pressure on the inside layers of the insulation can frequently be raised far beyond what the maximum-potential gradient theory would indicate without their breaking down. Outside layers seem frequently to break down at a much lower voltage than would be indicated by the maximum-potential gradient theory. Mr. Atkinson said it was therefore absolutely necessary to explain these phenomena before cables could be built depending only upon the maximum-potential gradient theory.

J. W. Lieb of the United States said he felt that in the cable industry, as differentiated from the other branches of electrical manufacturing and operation, the industry has distinctly failed to profit from the research and experimental work of early pioneers. It appeared to him that methods in use by many manufacturers have been of the most general character—for example, the use of mechanical spacing rather than a spacing based on fundamental principles.

Mr. Dunsheath of England called for the standardization of the method of making heating tests. As Luigi Emanueli had brought out, the power factor of the dielectric loss varies with temperature, yet some cables are tested with all of the dielectric at the same temperature and others are tested with the outer layer of the dielectric at about 60 deg. F., thus giving an entirely different result from the other method. He felt that cables could not be compared unless tested on the same basis.

Dr. S. Z. de Ferranti argued that electricity supply is too complicated today. In any new development such as electric service the first thing is to accomplish results, but these must then be followed by an attempt to carry out the processes more easily, and this means more cheaply. He concluded the discussion by saying that true knowledge brings simplicity, and toward simplicity the industry should work, for simplicity brings cheapness and cheapness brings universality.

POWER IN DOMESTIC USE

The two sessions devoted to papers on power in industry, in domestic use and in agriculture also excited attention and discussion. The replacement of gas by electricity—or at least the application of electricity in all cases of extensions of territory and other directions of growth, rather than the use of gas—was apparently a matter of much interest to many countries. Dr. W. Lulofs of Holland said he thought the lighting load was possibly a vulnerable one, for much more efficient lighting units would probably come and from the load curve standpoint, from the standpoint of the stability of the company, it is desirable to build much more of an energy-consuming load in residences as well as in industry.

Dr. S. Z. de Ferranti pointed out that a large part of the world's work is done in the house, and that there exists today no way to lighten this work except by electricity. The difficulty is that the industry meets all sorts of people, and must put into the hands of all sorts of people equipment which is foolproof. Experience in war-time production showed that machines in shops had harder handling from girls than the same machines had in the hands of what might be considered rough machinists. This points therefore to the serious problem of devising electric machines for household use which will stand up under all sorts of treatment.

With reference to the danger of depending on a lighting load, pointed out by Doctor Lulofs, Doctor Ferranti argued that what the human race needs from the physiological standpoint was not simply light but rather sunlight, and sunlight means power. He pointed out that the closer we can approach fresh-air conditions with radiant heat and light from incandescent lamps—that is, reproducting Nature's condition of fresh air and sunlight—the better it will be for the health and comfort of the world.

C. Le Maistre deplored the fact that there was not an organized effort within the electrical industry to devise and put into operation a maintenance plan for domestic equipment. One of the great limitations to the further use of domestic electric power is the difficulty which the average user has when anything goes wrong with his equipment. Mr. Le Maistre said that European experience showed very strongly that manufacturer and supplier together must work out some definite plan for continuing service to the customer on his equipment.

ELECTRICITY IN AGRICULTURE

Major Hj. Johansen of Norway pointed to the success of the electric "storage" stove in rural communities. This is a water-jacketed cooking arrangement which does most of its cooking at about 83 deg. C. and is based upon a kilowatt-year charge, as it is primarily a twenty-four-hour load.

A. F. Enström of Sweden said that with the widely extended distribution system to the farms in Sweden, the fixed charges have now become a considerable burden on the farmer because he uses this electricity for lighting only in many cases. Those who have motorized, however, naturally have reduced their average rate a great deal and are enthusiasts. Experience in Sweden has shown that the state is not a good agency to develop this greater load on the farms, because that is primarily a commercial transaction and can best be done through private enterprise.

One result of the more extended use of electricity on the farm in Sweden is that the milking of cows has made the women look at this farm chore in a different light. Mr. Enström gave this as an example of what it was possible to do by more intensive development.

Mr. Holmgren, also of Sweden, pointed to the opportunity of unity-power-factor motors to replace the usual induction motors, on farms particularly. Two things are accomplished—(a) much better regulation, but, more important (b) a great reduction in transformer sizes. He felt a 30 per cent higher cost and a 5 per cent lower efficiency in the unity-power-factor motor as compared with the induction motor will still save 25 per cent of the cost of power delivered on account of the reduction of losses.

RURAL SERVICE PAYING IN SWEDEN

Sten Velander from the Southern Swedish Power Company, a private company, said that the experience of his company showed that not only in the denser

agriculture work, but also in places where less than one-third of the land is arable, rural electricity was paying. Little industries can still be made to build up in such regions and absorb a power load. His company has shown profitable results and would regret to lose the load. The system is based on 20-kv. lines with transformer plants, built and owned by the company. The consumers as a group build a 1,500-volt network and pay 4 per cent per year for its maintenance by the company. The company also stands all losses.

The farmers who have constructed the network pay it off, principal and interest, in twenty years. The amount each man pays is proportioned to his connected load and runs about as follows: $1.50 per year per lamp and $10 per year per horsepower in connected power load.

At the end of twenty years it is calculated that the network will have been paid for, and subsequently there will be only maintenance charges, which are also apportioned according to the use the individual makes of the power. The actual power is then charged for at a little less than 6 cents per kilowatt-hour from dusk to 10 p.m. and a little more than 2 cents per kilowatt-hour for the rest of the time.

It has been possible under this plan to give enough profit to the company at a reasonable cost to the consumer. There has been neither politics nor charity but only good business. The present farms are about 50 hectares (125 acres), and when fully electrified, without plowing, it is hoped they will average 50 kw.-hr. per hectare; that is, a consumption of 20 kw.-hr. per acre per year.

RAIL TRANSPORT SESSIONS

The power for rail transport sessions brought out two points. One of these was a new system of motor design and power application in Hungary. This system is based on the principle that the voltage applied should be proportional to the square root of the power desired at the motor and that, as a consequence, the power factor will always thus be constant and a maximum. This makes for maximum efficiency and minimum peaks of power demands. It is, however, a constant speed system. A lengthy technical paper was presented to describe the system. The other point was made by W. S. Murray. After reviewing the six types of electrification in America and the reasons therefore, he discussed the present status and emphasized the need, regardless of detail, of having an agreement, in any nation, or even between nations in any general railroad area, as to a common type of energy supply to the roof of the locomotive. He related in detail some of the reasons for the adoption of the 11,000-volt overhead system on the New Haven, and also the satisfactory performance of alternating-current motors. Yet, he said, with the twenty years of experience with this and other electrifications, he had come to the conclusion that while the high-voltage alternating-current overhead supply was the ideal supply, the direct-current motor was the ideal motive power. It is safe to say, therefore, he said, that the motor-generator locomotive, for example, was a better type than the split phase and that the latter will disappear. The most important feature to hold in mind is the combined one of power supply to the railroads and the linking of that to, or drawing of that from, the main power supply of the region and, perhaps more important, relieving the railroads of the problem of financing the locomotive equipment by making it useful on all systems and therefore giving it a mortgage value. The one thing that was necessary to accomplish both these aims was a common type of power supply to the locomotive.

A well-attended research meeting heard several papers on research work. Dr. A. E. Kennelly, who presided, made a plea for more prompt and complete publication of research results, in the interest of the more rapid development of practical application in the power industry. The danger of too great concentration or centralization of research and the consequent elimination of some good minds which might otherwise be applied to difficult problems were also discussed.

ELECTROCHEMISTRY AND ELECTROMETALLURGY

Considerable interest was aroused in the sessions on electrochemistry and electrometallurgy by the announcement of Major Hj. Johansen of Norway that experiments completed last week indicate the success of a method to get 99.95 per cent pure iron by a direct process from iron ore in an electric furnace (see ELECTRICAL WORLD, July 26, 1924, page 194). E. P. Mathewson greeted this, if commercially practicable, as the realization of a half-century dream.

At the standardization session, the question of standardization work in connection with prime movers and related mechanical subjects came up, as it was felt by some that possibly the International Electrotechnical Commission was too limited in scope to consider such problems. This viewpoint was dispelled by both Dr. Semenza, president of the commission, and C. O. Mailloux, honorary president, who stated that as far back as 1912 the commission had established a prime-movers committee to consider these questions and that there had been some progress. The International Electrotechnical Commission will thus welcome requests, as the one organized body to administer study of electrical and associated standards, to undertake specific work in these lines. The conference felt, under the circumstances, that this was the best procedure and adopted the motion or recommendation already referred to.

The final session of the conference on Friday afternoon was intensely interesting. It consisted of short talks by representatives of fully half of the countries represented, each giving his measure of the good of the conference and its practical accomplishments. Beneath what many might term the usual patter of complimentary remarks, one could not help detect a foundation of genuine appreciation that the conference had been of real value. This was strengthened by individual conversations with various representatives from many countries. It is interesting to note that the greatest acclaim was given to the final address of the German delegate, who evidenced a real appreciation at the invitation to Germany to participate in the conference in Great Britain and of the reception they had had. Russia was also actively represented and spoke of her earnest desire to help develop electrical power for the general betterment of the condition of the entire population. It is recognized in Russia that the laboring man will benefit most from the proper development of power. There were many mentions of specific things that would prove of importance to carry back to certain countries. And most of all there was the sentiment that this conference had proved that engineers, who deal with facts and not with sentiment or political considerations, can most effectively get together to discuss their common problem.

A discussion of the conference would not be complete without relating a few of the sidelights. First, it

should be mentioned that the conference, immediately on being advised in each case—adopted an appropriate resolution to be forwarded to President Coolidge regarding the untimely death of his son, and it also sent a resolution of sympathy and of appreciation on the death of B. G. Lamme of the Westinghouse Electric & Manufacturing Company.

The engineers of Great Britain have taken this occasion to extend every courtesy to the visiting engineers. The Mechanical Engineers have held a banquet for visiting mechanical engineers. The engineers of all kinds have invited their fellow engineers to two "conversaziones" last week and next week. And the electrical engineers have been particularly hospitable—in arranging to have all visiting electrical engineers invited to the King's Garden party; in securing special reservations at Westminster Abbey; in taking all visiting electrical engineers on an inspection of Cambridge University, supplying a special train for the event; in arranging a similar excursion, with the visitors as guests, always, to Birmingham and to Stratford-on-Avon, and in many other ways. It was also a most happy incident that the Kelvin Centenary Celebration and the presentation of the Kelvin Medal to Dr. Elihu Thomson came just at this time.

And one last act of the conference was to authorize the international executive committee to arrange to purchase Heathfield Hall, the home of James Watt, to be offered at public auction next Saturday, so that it may be maintained as a permanent monument to the "father of power." The house and workshop remain just as Watt left them.

Station Readings Brought to Dispatcher

Records of the Loads at Three Generating Stations Are Transferred Over Telephone Lines to Indicating and Recording Equipment in the Load Dispatcher's Office by Simple, Accurate Method

By RAYMOND BAILEY
Philadelphia Electric Company, Philadelphia, Pa.

FIG. 1—VIEW SHOWING GENERAL ARRANGEMENT OF LOAD DISPATCHER'S OFFICE

THE Philadelphia Electric Company has recently installed in its load dispatcher's office equipment for indicating and recording the total kilowatts generated at each of the generating stations and the total kilowatts for the entire system. This installation was made primarily to facilitate the distribution of load between stations and to assist in the rapid restoration of normal conditions at times of trouble. The equipment helps in two ways in case of disturbance on the system—first, in that the load dispatcher has immediate notification and, second, because from the readings of the instruments he can tell which station is most affected and from the same readings combined with his knowledge of the generating capacity in service in the different stations can tell which station can best pick up the load which may have been dropped by the station in trouble. The ability to read the total kilowatts generated at any time without the necessity of adding a number of readings is also quite an advantage.

The load dispatcher's office is in the general office of the company at 1000 Chestnut Street, Philadelphia, and of the three generating stations involved—namely, Delaware, Schuylkill and Chester—the first two are about 2 miles and the third about 14 miles from this point. The Schuylkill frequency-changer station, which

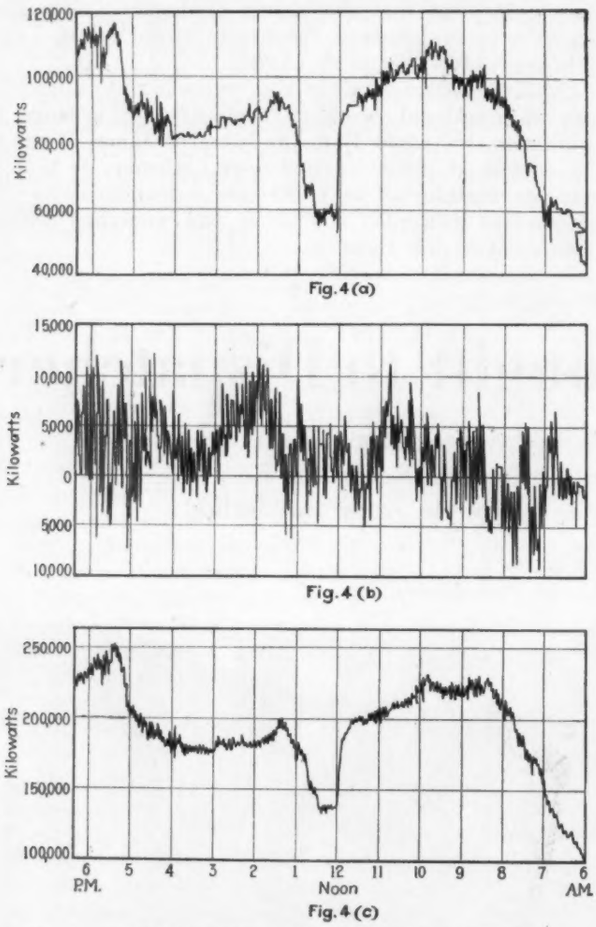


FIG. 2—GRAPHIC CHARTS TAKEN FROM LOAD RECORDING METERS

(a) Delaware generating station. (b) Schuylkill frequency-converter station. (c) System totalizing meter.

ties the 25-cycle and 60-cycle systems together, is of necessity involved in determining the total kilowatts of either frequency delivered to the system, although obviously the readings of its recording meter are not included in the system totalizing meter. This station is adjacent to the Schuylkill generating station.

The generating capacity in each of the stations involved is as follows:

Station	Frequency, Cycles	Present Capacity, Kw.
Delaware	60	150,000
Chester	60	60,000
Schuylkill	60	76,000
Schuylkill	25	80,000
Schuylkill frequency changer	60-25	22,000

The principle of operation of the load-metering equipment under discussion is as follows: In the generating station there is a transmitter which impresses on a telephone pair connecting it with the receiving equipment of the load dispatcher's room a potential directly proportional to the kilowatts generated. The transmitter in each case is connected to a graphic wattmeter that was previously installed in the generating stations to measure the same blocks of power that it is desired to indicate and record in the load dispatcher's office. The recording instrument impresses on the telephone pair a potential which varies directly with the motion of the recorder pen carriage and which is opposite in polarity to the potential impressed on the same pair by the transmitter. The recorder mechanism is such as to cause the pen carriage to move until the potential impressed by the recording instrument is exactly equal and opposite to that impressed on the same pair by the transmitter. When the point of balance is reached by the pen carriage the galvanometer in the recorder, which is in series with the telephone line, is carrying no current and stands at its "zero" position, where it has no further effect upon the motion of the pen carriage until the potential impressed by the transmitter changes. As the potential of the recording device is balanced against that of the transmitter in the generating station, its indication will be proportional to the generated kilowatts.

Because of the fact that no current flows through the telephone pair when the recorder mechanism is balanced, the balance point is independent of the resistance of the line, and this is of great importance when using a long line of small gage, particularly if this line is subject to temperature variations.

Fig. 4 shows the general schematic connections of the load indicating and recording system, the various parts of which function as described below.

The transmitting devices in the generating stations are slide-wire resistors chain-driven by the same motor that operates the pen of the graphic recording wattmeters and as mentioned above are arranged so that the potential they impress on the wire connecting with the load dispatcher's office is proportional to the kilowatts measured by the graphic meter. The source of potential is two dry batteries in parallel. The voltage of these cells is periodically checked by means of the standard cell and the galvanometer by momentarily closing the contact switch, shown in detail in the upper left hand corner of Fig. 4. If a deflection is obtained it indicates the necessity of adjusting the rheostat for zero deflection or possibly the replacement of the dry cells.

As mentioned above, the electrical connections between the transmitters in the generating stations and the equipment in the load dispatcher's office are standard telephone pairs. The use of telephone pairs for this purpose is not at all detrimental to telephone service as the voltage and currents employed are very small.

The recording instrument consists essentially of a motor-operated mechanism controlling the chart pen and the position of a slide-wire resistor arranged so that the variable potential obtained from this resistor is proportional to the distance of the pen carriage from the zero position. A sensitive galvanometer which is also part of the equipment is connected in series in the circuit connecting the recorder with the transmitter and controls the operating mechanism so as to reduce the current in the line to zero. When the current on the line is reduced to zero the mechanism is in a balanced condition and the opposing potentials of the transmitter and recorder are equal.

The potential for the slide-wire resistors in the recorders is obtained and checked in the same manner as in the transmitter.

Each recording device has two slide-wire resistors in addition to the one that balances against the transmitter potential, except the one for Schuylkill substation, which has one. One slide-wire resistor of

each recording meter, except the one for Schuylkill frequency-changer station, is connected in a series circuit, the combination of which gives a potential proportional to the total kilowatts generated, for operation of the system totalizing recorder. The remaining slide-wire resistor in each recording meter is connected to an individual indicating instrument calibrated to read in kilowatts and arranged so that its deflection is independent of variation in supply voltage. These instruments are used to enable the load dispatcher to read the kilowatts generated without referring to the recording meters, which could not be located to the best advantage for this purpose. The use of the indicating instruments is also an advantage in that they are provided with scales much more easily read than it would have been possible to use on the recording devices. Fig. 1 is a view of the load dispatcher's room showing the arrangement of this equipment. The indicating instruments, it will be noted, are placed so that they can be easily read by the load dispatcher without turning around. Provision, of course, has been made so that the instruments for additional generating stations can be added to the system as they are built.

Fig. 3 is a close-up view showing the six recording devices installed at present, five of which are used to record individual blocks of load and the sixth for the entire system.

Fig. 2 shows sections of graphic charts taken from the Delaware generating station, the Schuylkill frequency-converter station and the system totalizing meters. The chart for the frequency-converter substation shows how this station takes up load swings between systems which may call for direct or reverse operation from time to time.

The advantages that a system of indicating and recording of the generated load would bring to the co-ordination of the work of the load dispatcher were realized at the outset; investigations of possible means of automatically transmitting this information into the load dispatcher's office were undertaken in co-operation

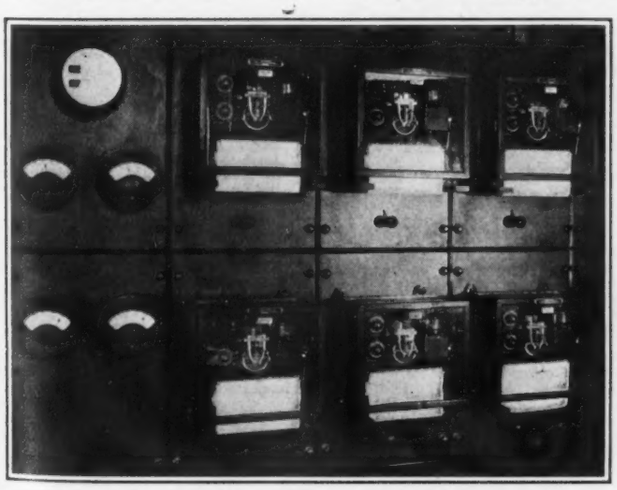


FIG. 3—CLOSE-UP VIEW OF PANELS, SHOWING LOAD-TOTALIZING RECORDING METERS AND INSTRUMENTS FOR INDICATING FREQUENCY AND VOLTAGE

with manufacturers of electrical apparatus, and indications pointed to the possibility of using a system of meters which would utilize low voltages balanced against each other, thus giving zero current under steady load conditions. The equipment for this purpose, as described above, was furnished by the Leeds & Northrup Company of Philadelphia and operates very satisfactorily.

Fig. 1, showing the general view of the load dispatcher's room, also gives an idea of the remainder of the load-dispatching equipment, which includes a large semicircular board with the station layouts indicated

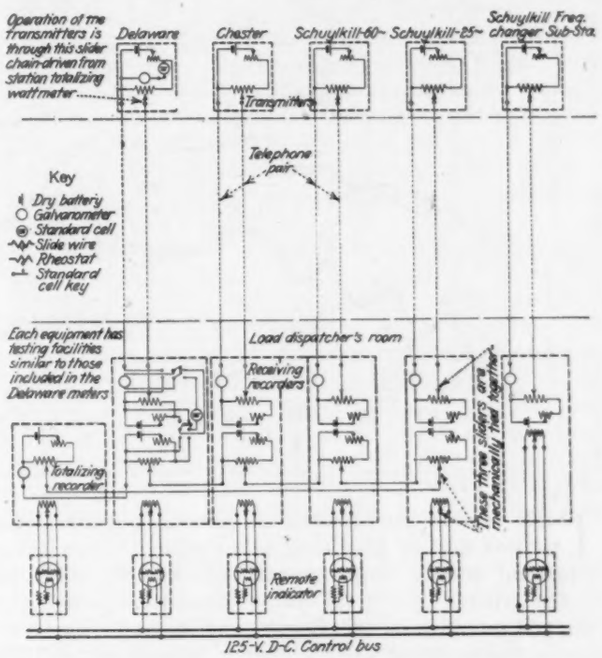


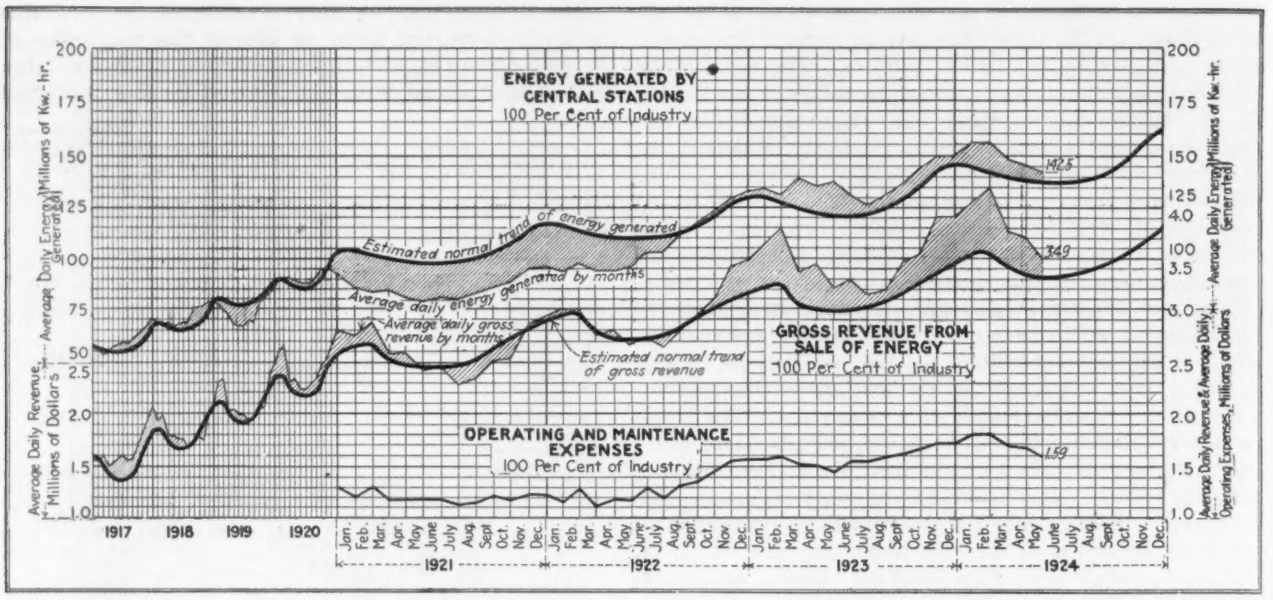
FIG. 4—SCHEMATIC DIAGRAM OF ELECTRICAL CONNECTIONS OF LOAD INDICATING AND RECORDING SYSTEM

thereon. Circuit breakers for lines with voltages of 13,200 and higher are represented by telephone signal lights operated by the keyboard built in with the telephone operating switchboard used by the load dispatcher. The circuit breaker in a closed position is indicated by the light with a green lens in front of it, and when the light is out the circuit breaker is open. The condition of the circuit breaker open and blocked is indicated by the light with a red lens in front of it. Any unusual condition is indicated by the light with a white lens in front of it. These indicating lamps are regularly supplied through a transformer from the alternating-current system or can be supplied through a direct-current motor-generator set from the Edison system, or in case of emergency from a storage battery which also supplies emergency lighting in this room, as well as in the trouble dispatcher's room and the telephone exchange.

The telephone board has direct wires to all of the company's generating stations and substations. To the right of the telephone switchboard is a telautograph which connects with the trouble dispatcher's office. At the left side of the room, just beyond the totalizing recording meters, there is a Warren master clock which is used for maintaining correct average system frequency.

The instrument equipment in this room also includes a frequency indicator and a voltmeter for both the 60-cycle and 25-cycle systems, the potential for their operation being obtained from the substations in the vicinity. There are also two direct-current voltmeters connected to the Edison three-wire system, which supplies an important block of load in the center of the city.

Industrial Power Requirements Less Than Last Year


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
Estimated normal trend of energy generated
Average daily energy generated by months
Average daily gross revenue by months
Estimated normal trend of gross revenue
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
142.5
134.9
115.9
Average Daily Revenue, Millions of Dollars
Average Daily Energy Generated, Millions of Kw.-hr.
Operating Expenses, Millions of Dollars
1917 1918 1919 1920
1921 1922 1923 1924

THE further curtailment in general industrial activities during May, and a consequent decrease in industrial energy requirements, was clearly indicated by the reports of central station operations which are received monthly by the ELECTRICAL WORLD from companies representing approximately 75 per cent of the installed generator rating of the country. While the total amount of energy sold to all consumers during May was 3.3 per cent over that sold during May of last year, the amount of energy consumed by industrial power customers during the month was about 16,000,000 kw.-hr. under that of last year. The energy consumed for lighting purposes, however, was about 100,000,000 kw.-hr. over that of last year, and the consumption by electric railways also increased, so that the aggregate

TABLE III — OPERATIONS OF CENTRAL STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Energy Generated				Fuel Consumption		
	Hydro Plants		Fuel Power Plants				
	Thousands of Kw.-Hr.	Per Cent	Thousands of Kw.-Hr.	Per Cent	Coal (Short Tons)	Oil (Barrels)	Gas (Thousands of Cubic Feet)
1924							
*March.....	1,705,060	37.1	2.890,900	62.9	2,781,084	1,496,604	3,099,314
*April... ...	1,814,599	41.7	2,535,813	58.3	2,479,826	1,168,291	2,747,341
*May.....	1,909,356	43.3	2,506,794	56.7	2,423,065	1,120,112	2,894,262

*As collected by U. S. Geological Survey. The data are for the electric light and power industry only.

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Mos.	Kw.-Hr. Generated Monthly			Distribution of Energy Generated										Kw.-Hr. Purchased for Resale	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting Kw.-Hr.		Energy Consumed for Power Kw.-Hr.		Energy Sold to Electric Railways Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands
March.....	*4,595,960	4,331,208	6.1	3,707,960	3,494,208	788,000	683,000	2,397,260	2,319,708	522,700	491,500	888,000	837,000	787,000	634,000
April.....	*4,350,412	4,084,611	6.3	3,510,412	3,295,111	749,000	649,500	2,247,412	2,162,611	514,000	483,000	840,000	789,500	732,500	590,000
May.....	*4,416,150	4,272,596	3.3	3,564,650	3,448,096	756,500	656,000	2,276,150	2,292,096	532,000	500,000	851,500	824,500	733,000	621,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities, minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Mos.	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1924 Thousands	1923 Thousands	Per Cent Increase	1924 Thousands	1923 Thousands	Per Cent Increase	1924	1923	1924	1923	1924	1923
March.....	$116,600	$106,000	10.1	$52,600	$47,300	11.1	48.6	51.3	28.6	26.5	46.2	44.7
April.....	111,500	102,500	8.8	50,200	45,150	11.1	49.2	49.8	29.0	28.9	46.8	44.8
May.....	108,200	100,000	8.2	49,300	45,700	8.0	51.7	52.8	32.0	26.2	44.9	44.3

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

consumption was more than that of last year. A gain of only 3.3 per cent per annum is the lowest percentage gain recorded since December, 1921, at which time the industry was just recovering from the great industrial depression of that year.

The central stations of the country generated a total of 4,416,150,000 kw.-hr. in May, or a daily average of 142,500,000 kw.-hr. A study of the accompanying diagram indicates that the energy generated by central stations during May was 3.4 per cent above what it would have been if the energy requirements of the industry had been normal.

A total of 851,500,000 kw.-hr. was used in intra-company business and lost on the lines during May, leaving a total of 3,564,650,000 kw.-hr. sold to actual consumers. Of this amount 21.2 per cent was consumed for lighting, 14.9 per cent by electric railways and 63.9 per cent for industrial power purposes.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Thunderstorm Researches Versus No Lightning Arresters

To the Editors of the ELECTRICAL WORLD:

Mr. Creighton in his comments in your March 15 issue on my article appearing in the February 2 issue quotes the researches of L. A. De Blois, who observed lightning discharges with an ordinary oscillograph. "Some of these induced charges were non-oscillatory. However, the changes in the potentials of the clouds were many times as rapid as those measured by Dr. Norinder. Furthermore, the sharp peaks and the sudden changes of potential obtained by Mr. De Blois suggest that Dr. Norinder might well re-examine the degree of damping in his circuit." Mr. Creighton may rest assured that this point has been carefully considered during the work. The antenna circuits used had lengths of 100 m. to 300 m. and the dampening resistances were a few thousand ohms. This gives an aperiodic damping with time constants of the order of some microseconds. It is therefore perfectly justifiable to assume that practically the antenna voltage instantly followed the field variations.

Mr. Creighton, however, omits to mention the interesting fact that Mr. De Blois was working without any extra damping at all in his antenna. It is quite obvious that without extra damping oscillations of the natural period of the antenna must be produced by any type of external excitations. This may give an explanation of the sharp curve peaks observed in some cases by Mr. De Blois. I may refer the interested reader to the comments by the United States Bureau of Steam Engineering (*Monthly Weather Review*, No. 8, Vol. 42, page 500, 1914) upon the researches of Mr. De Blois.

Similar problems have been treated by R. A. Watson and E. V. Appleton (*Proc. Roy. Soc.*, London, Series A, Vol. 103, No. A-720, April, 1923). These authors describe visual observations with a cathode-ray tube on 600 typical radio-telegraphic atmospherics. These 600 atmospherics were observed to be of an aperiodic or quasi-periodic type of time variations, and the authors make the following comments on their own results: "A second group of almost equally frequent occurrence consists of aperiodic impulses of duration, generally about 1,250 microseconds, but frequently reaching 0.025 of a second." Many of the observed atmospherics evidently must have been caused by distant lightning discharges, and the researches of Appleton and Watson therefore confirm the authors' opinion of lightning discharges as unidirectional, slow and aperiodic.

W. J. Humphreys gives very good evidence ("Physics of the Air," page 385, Franklin Institute, Philadelphia, 1920) that a resistance along the lightning path of the order of 200 ohms per kilometer, or 0.002 ohm per centimeter, would always suffice absolutely to prevent electrical oscillations between cloud and earth. It is not easy to visualize a discharge channel with less resistance than this.

It is very difficult to find in the article commented on any foundation for Mr. Creighton's speculations about 100,000-volt bushings on 2,300-volt transformers. Admitting that lightning discharges are relatively slow, the surface leakage on the insulators of any moderate voltage system will very effectively ground the line and prevent static overvoltages. Mr. Creighton says: "The cost of one bushing would equip all the transformers in a large district with 2,300-volt lightning arresters." The arresters probably would be a better investment than the bushing, but this does not prove that a still better investment could not be found.

Another comment of Mr. Creighton is this: "Each season there are thousands and thousands of lightning discharges of absolutely harmless nature which take place through lightning arresters." No doubt, but does this prove that anything would have happened at all if the arrester had not been there? And when thousands of "harmless" discharges take place, may not the secondary, steep, perhaps oscillatory discharge waves hammer the transformer insulation in the same way as the original disturbances? On the other hand, there is no arrester designed, and probably never will be, that gives any sort of protection against a direct stroke of lightning on a line.

Lines of extremely high operating voltage where the leakage on the insulators is very small are well protected by their very strong insulation and by corona formation. Intermediate voltage systems seem to be more exposed. An example will show this. In a Swedish distribution system there were used under similar service conditions 250-volt bushings for 20 kv. and 700-volt bushings for 3 kv. During four years about a dozen flashovers have been observed on the 20-kv. bushings but none on the 3-kv. bushings, although the length of the lines in the 3-kv. system is twice that of the 20-kv. system. No lightning arresters were installed on either of the two systems.

Mr. Creighton is quite right in pointing out that nobody yet has ventured to put up a laboratory inside the "hot" lightning cloud. He is also right in pointing out that "it is the lightning phenomena in the wires, not clouds, that are of vital importance to the industry" —at least until Mr. Creighton's power transmission from Victoria Falls, Africa, to Chicago, Ill., via "a super-Eiffel Tower on a mountain top through a captive balloon to a high conducting layer" becomes more of a reality. In the meantime I think we can safely assume that if the thunderstorm field changes aperiodically near the earth's surface, where the lines are, there are certainly no oscillations in "the hot part of the thunder cloud" shorn by the venerable Franklin.

Royal Board of Waterfalls,
Stockholm, Sweden. DR. H. NORINDER.

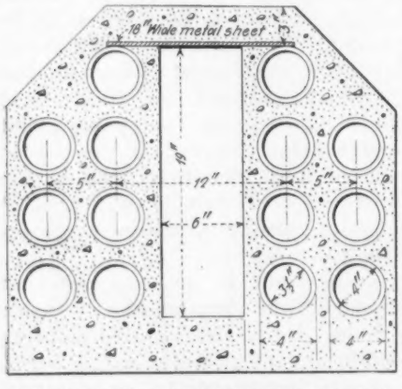
Central Station and Industrial Practice

Dayton Underground Conduit System

By L. A. Bryant
Dayton Power & Light Company, Dayton, Ohio

HIGHER heat conduction in underground ducts was the aim of the engineering department of the Dayton Power & Light Company when it was decided to use underground construction in building the distribution circuits from Miller's Ford station and the Fourth Avenue substation. The old method of laying ducts close together in concrete provided poor means of ventilation of the inner ducts. Hence, the heat generated by the load on the inner cables was not carried away readily, which resulted in a decreased rating and life of the cables.

To overcome this objection, the present practice is to use fiber conduit laid as shown in the accompanying illustration. The conduit is made of pressed wood pulp, impregnated with a bituminous compound which insulates it and makes it weatherproof. The conduit has a 3½-in. bore and is 5 ft. long. The trench is first excavated and the bottom carefully graded to avoid pockets. A bed of 4 in. of concrete is then poured on the bottom of the trench and graded to the grade



TYPE OF DUCT WHICH INCREASES HEAT FLOW FROM CABLES

stakes. As the formation used requires a 6-in. separation between the two sections, it is necessary to set forms for this opening. These forms are made in 12-ft. sections so they can be used repeatedly after cleaning and oiling. After these forms are set the ducts are concreted in on both sides. When this concrete has set the forms are removed, an expanded metal lath is laid over the 6-in. opening and concrete is then poured to form the top, making a complete duct formation. This improved method of laying ducts has the advantage of more complete ventilation of the duct runs, with a corresponding increase in the load-carrying capacity of the inner cables and the life of the cable.

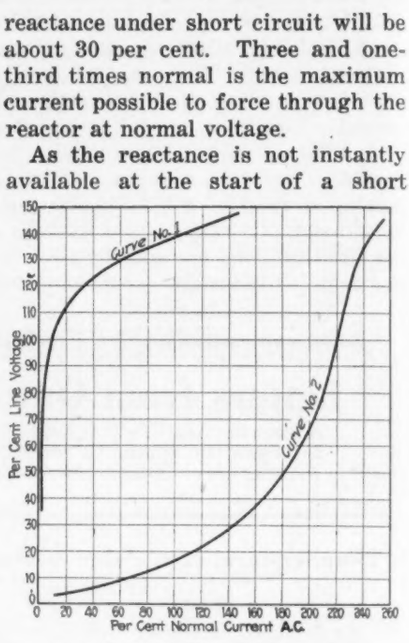
The excavation for this installation was handled by a clam-shell and dragline bucket mounted on a 5-ton truck. Due to the sandy location, the crane excavated about 130 linear feet of trench per day, equivalent to 215 cu.yd. At this rate it required about five days to do a section of 470 ft. The system required eighteen sections. The concrete work was done by a crew of two men loading the mixer, one man operating the mixer, one man unloading the mixer and two men wheeling the concrete to the trenches. Two other men were required to lay the ducts in the trench.

Characteristics of Iron-Core Reactors

THE characteristics and applications of the saturated-core reactor and regulator were discussed in a recent paper by D. K. Blake before the A. I. E. E. at Chicago. It is interesting to note that the voltage drop across the iron-core reactor increases directly with the current up to a certain point only, and then the voltage curve bends over as shown by curve 1 of the accompanying illustration. If the iron-core reactor is magnetically saturated by the application of direct current, then the voltage drop across the reactor increases in a greater proportion than the current between certain points, as shown by curve 2.

It is this characteristic of the saturated-core-type reactor which will determine its application in place of the air-core-type reactor. The reactor can be designed with a ratio of reactance under short circuit to reactance at normal load of three to one; that is, if the normal load reactance is 10 per cent, the reactance under short circuit will be about 30 per cent. Three and one-third times normal is the maximum current possible to force through the reactor at normal voltage.

As the reactance is not instantly available at the start of a short



CHARACTERISTIC CURVES OF THE IRON-CORE REACTOR

circuit, owing to the fact that the flux cannot change instantly, it possesses no advantage over the air-core-type in protecting a system from the initial electromagnetic forces under short-circuit conditions. It does, however, reduce the current to be interrupted by an oil circuit breaker in series with the reactor.

Various applications of this type of reactor have been devised, and one of the most important is to use it to insure continuity of service to house or station auxiliaries when they are operating in parallel with the main generator. They also may be used as a variable reactance by varying the direct-current excitation. It is used in this manner in transoceanic radio communication to modulate the antenna current of the Alexanderson alternator and to control the speed of the induction motor driving the alternator. When used to control the speed of the induction motor the reactor is connected in series with the motor primary leads. The saturated-core reactor could also be used as a variable shunt reactance to control the lagging kilovolt-amperes required to counteract the charging current of very long, high-voltage transmission lines during light load conditions.

Ships Use Central Station Power While in Port

BY L. B. SAWYER
South Portland, Me.

BY USING power from the local central station, ships while in port can save a large amount of fuel and also be able to make much more extensive repairs without danger of overloading the ship's generators. Several instances of this practice may be found in Portland and in Baltimore.

Many ships having regular routes and docking at the same wharf each trip could easily make use of central-station energy if connections were available. If a coal-burning ship uses its own generator in port it is necessary to keep at least one fireman and one oiler on duty at all times. Besides this, there will be extra ashes to be stored until open sea is reached, as federal laws prohibit dumping ashes in harbors.

Other items against the ship's generator will be: Lubricant, wiping waste, wear and the ever-present danger to the commutator or the whole unit during heavy repairs. If central-station energy is used one fireman only would be necessary at all times, but the fireroom crew can usually operate the injectors, releasing the other night men for day work, of which there is always an abundance. In very large ships where numerous auxiliaries are in operation continuously the saving would be only the cost of generation as oilers would be on duty at all times.

The figures which follow are based on fuel oil saved on a typical coastwise freighter. The saving would be much greater on a passenger ship. It was found that the extra oil used in port, while the ship's generator was running, over that used when the generator was shut down and central-station energy supplied cost $30.89 per twenty-four hours, while the central-station energy cost $4.22 per twenty-four hours, a saving of $26.67.

The connections are made through armored cord and a plug into a receptacle housed in a weatherproof box on the wharf.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Meter Installations

SPECIAL care and attention must be given to meter installations. On new installations, except in emergencies, no meters shall be set until the rules and regulations of the company in reference to inclosed safety switch, meter-board and conduit service entrance have been complied with. Where meters are grouped each shall be marked so as to plainly indicate the floor, office or section of the building which is supplied. Single-phase meters shall be placed not less than 15 in. apart on centers. The marking shall be of such type as will remain permanently legible as, for example, by painting on the safety switch box.

At primary meter installations the safety of inspectors and meter readers depends upon the installation of the current and potential transformers and, therefore, they shall always be properly installed with reference to the meter, and their insulation properties shall be maintained in their highest state of perfection.

Meters shall be mounted not higher than 7 ft. nor lower than 4 ft. above the floor and as near as possible to the point of entrance of the service, preferably in the basement, as shown in Fig. 79. In all cases meter boards will be located in a clean, dry, light, safe and easily accessible place. The mounting surface shall be free from vibration. Meters shall not be insalled in coal bins, attics, on roofs, stairways, in bedrooms, closets, restaurant kitchens, over or near doors or windows, in bath or toilet rooms, in any room commonly kept locked, elevator or ventilating shafts, near stoves, near steam or gas pipes nor under any water pipe from which, as a result of sweat, water may drop. When a damp or dusty location is unavoidable a cabinet in accordance with Fig. 80 shall be provided by the customer.

Meters shall not be placed behind or near belts, gears or machinery unless there is ample space for reading and testing. Alternating current circuits of over 460 volts shall not be permitted below the meter nor closer than 2 ft. above or on either side of the meter or 3 ft. in front unless thoroughly protected by conduits or barrier.

If properly protected by a weatherproof box as shown in Fig. 80, the meters may be located on covered back porches and, if necessary, on buildings or poles.

Meters may be located upon customer's switchboard if a blank panel not less than 20 in. wide and of standard 90-in. height is left on the board for mounting the meters according to the standard method of installation.

High-tension meter transformers shall be located outdoors so that the tops of the bushings may be brought to a safe and convenient location for connecting to the high-tension circuit.

At installations requiring both a graphic or demand meter and a watt-hour meter, both meters shall be located upon a steel meter-mounting box.

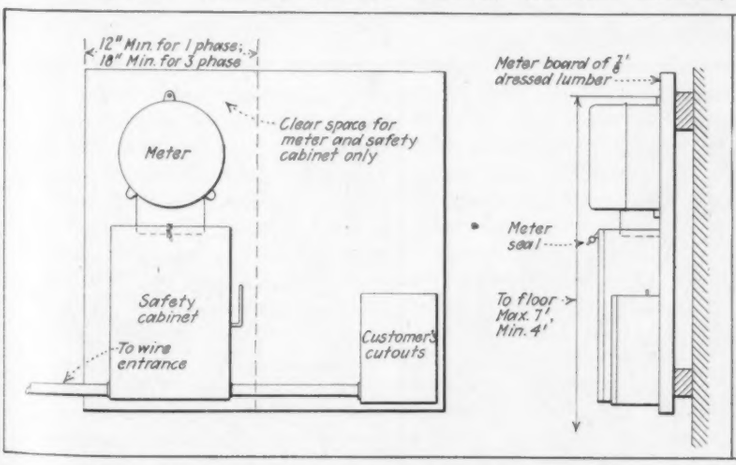

12" Min. for 1 phase;
18" Min. for 3 phase
Meter
Clear space for meter and safety cabinet only
Safety cabinet
To wire entrance
Customer's cutouts
Meter board of 7/8" dressed lumber
Meter seal
To floor Max. 7', Min. 4'

FIG. 79—METER BOARD AND METER CLEARANCES

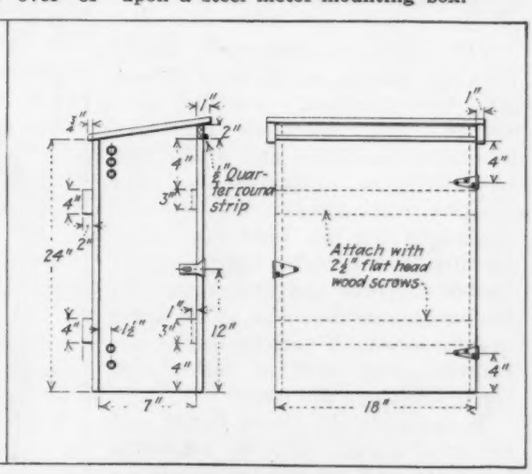


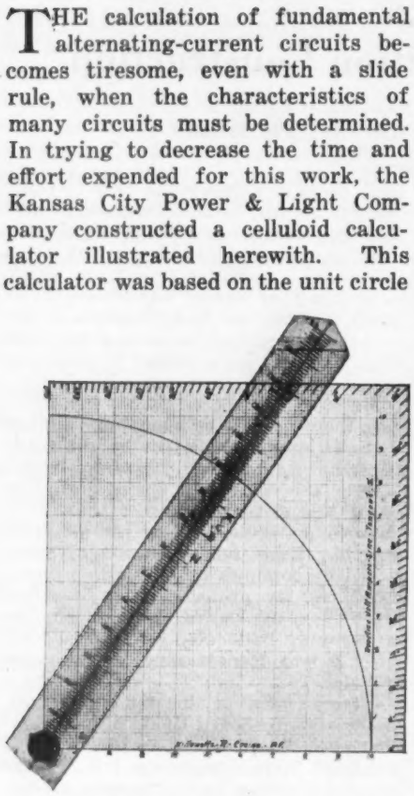
FIG. 80—WATT-HOUR METER BOX

Fig. 80—The meter box shall be constructed of clear, well seasoned pine or poplar lumber, free from cracks. The sides, top and bottom shall be made from single pieces of ¾-in. lumber. The door and back of the box shall be made from ¾-in. tongue and groove stock. The top shall be covered with painted canvas and the entire box shall be made moisture-proof by a coat of good weather-proof paint. With ordinary service in the conduit, entrance to the meter box may be made through the back of box. Drill holes in sides of the meter box only when open wire construction is necessary.

Speedy Calculator for A.C. Circuits

BY R. L. FRISBY
Electrical Engineer of Stations
Kansas City Power & Light Company,
Kansas City, Mo.

THE calculation of fundamental alternating-current circuits becomes tiresome, even with a slide rule, when the characteristics of many circuits must be determined. In trying to decrease the time and effort expended for this work, the Kansas City Power & Light Company constructed a celluloid calculator illustrated herewith. This calculator was based on the unit circle



A HANDY CALCULATOR BASED ON THE DESIGN OF A UNIT CIRCLE

principle of trigonometry with a celluloid arm swinging as the radius of the circle, thus changing the sides of the vector triangle as desired. This radius arm is fastened permanently at the origin of the circle.

The construction was quite simple once the proper scales were chosen for the abscissa, ordinate and radius. The abscissas represent kilowatts, resistance and power factor while the ordinates show the reactive volt-amperes, the sine of the angle and the reactance. The movable radius arm indicates the kilovolt-amperes and impedance. On the outer scale the value of the angle is determined. When calculating unknowns, care must be taken that correct settings are made.

To calculate the power factor and the total kilovolt-amperes when the kilowatts and reactive volt-amperes are given, the radius arm must be set at these two respective values and then the point dropped from the end of the hypothenuse of the circle to the abscissa which indicates the power factor. Example: Kw. = 4,000; reactive kilovolt-amperes = 6,000; find kva. and power factor. Solution: set radius at intersection of 4,000 on abscissa and 6,000 on ordinate and read kva. on hypothenuse = 7,200. To get the power factor follow up the radius arm to the circle and read the abscissa value of this intersection = 55.5.

This calculator may be utilized in checking other values as well as for parallel circuits and has been very beneficial in lowering time spent for calculations.

Designing a Distribution System for Congested Areas

BY C. G. WATSON
Engineering Department, Duquesne Light Company, Pittsburgh

DUE to the overloading of the existing distribution system in its downtown alternating-current district the Duquesne Light Company has had to develop and place in operation a new system of distribution. It was decided to develop a system to distribute at 4,000 volts, three-phase, to all consumers of 60 kva. and upward and to give to each of these consumers both a regular and a duplicate service. Smaller consumers are to be supplied from a system of low-tension mains fed at suitable points from transformer vaults, in turn fed by the 4,000-volt mains. This article deals with the latter.

Two schemes of feeder layouts were prepared and one scheme of distribution mains which would answer for either scheme of feeders. Both feeder schemes provide for a regular and a duplicate supply, the distinctive difference between the two being that Scheme 2 allows a greater margin of safety in the event of the failure of a substation. This greater margin is obtained by an expenditure of approximately $30,000, and therefore Scheme 2 is the one that has been adopted.

In designing the schemes, the following considerations were uppermost in mind: (a) each consumer to be fed from duplicate sources, so that if a substation is shut down, or if either one of two adjacent feeders or their connected mains is faulty, then service to those consumers supplied by such substation or feeder is uninterrupted; (b) an allowance to be made for growth of load; (c) the layout to be such that additions can be made with little disturbance to feeders and mains already installed under the scheme, and (d) the substations to have the least capacity needful to cope with the condition of duplicate service.

For this service the supply is three-phase, 4,000 volts, with the capacity of each feeder 2,080 kva. The sources of supply are to be the Grant, Stanwix and Thirteenth Street substations. In the event of the failure of any one of these substations the two others share the load, and in the event of failure of any feeder, adjacent feeders carry the load of the faulty one. The total present connected load is approximately 30,000 kva. The average

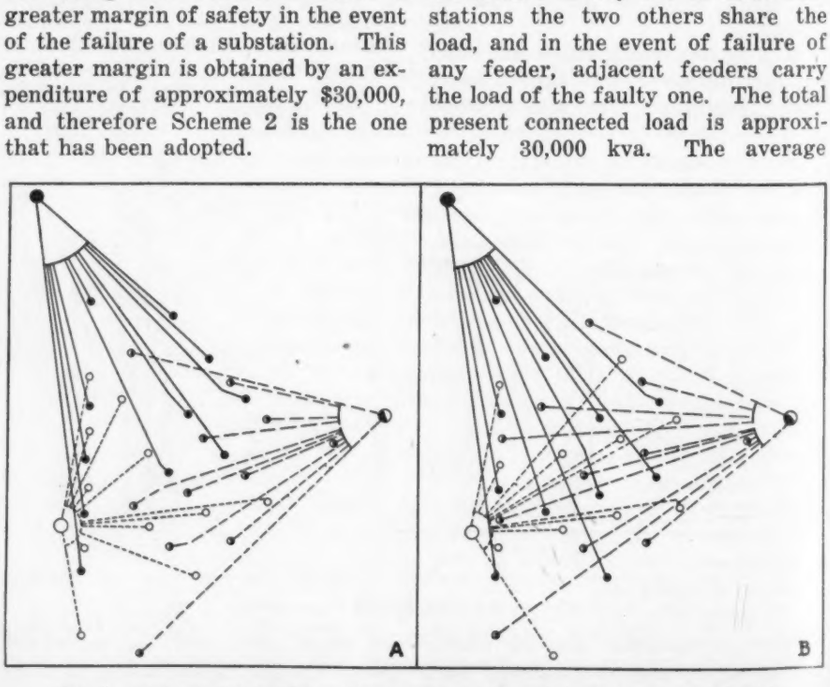


FIG. 1—TWO SCHEMES FOR SUPPLYING A CONGESTED DISTRIBUTION SYSTEM

rate of growth of the load during the past three years has been 30 per cent a year.

Seeing that the length of the feeders and the supply voltage are such that the maximum drop is in the neighborhood of 1 per cent (this condition permits of the same cables being used for both power and lighting loads), and seeing that the feeders are not connected in parallel at the ends remote from the substations, it was needless to consider voltage drop, and therefore the locations of the feeding points have been based upon considerations as to the most economical positions under the circumstances of duplicate service. These considerations show that the greater the number of feeders which can be meshed the greater is the resulting economy in feeder copper.

In both schemes there are thirty-three feeders, one-third of which are run from each substation, so that under regular working each substation is equally loaded. In both schemes provision is made for the failure of one substation and for the failure of at least one of any two adjacent feeders.

Scheme 1 is such that it requires the shortest length of feeder cable to comply with all the basic requirements. A diagram of the normal arrangement of feeding points and mains is given in Fig. 2D, from which it will be seen that a feeder and its mains are meshed with those having their source at one other substation.

If this scheme were adopted and if complete provision were to be made for the shutting down of one substation, then the regular load to be carried by each feeder would not have to exceed 1,040 kva., and assuming that the present rate of growth continues, the system would become fully loaded in about two years. But, on the assumption that provision were only made for the failure of a feeder, then the regular load of each feeder could be, on the average, 1,560 kva. and the system would become fully loaded in three and a half years, while in the event of a substation failure, the feeders affected would be overloaded to the maximum extent of 60 per cent.

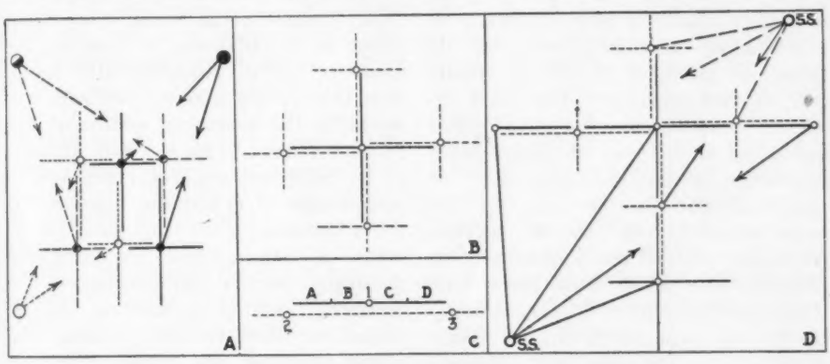


FIG. 2—DETAIL ARRANGEMENT OF DISTRIBUTION FEEDERS

It can be shown that (a) when two feeders and their connected mains mesh, which is the minimum needed for duplicate service, then each feeder can normally only be loaded to one-half of its capacity; (b) when three feeders mesh, normal load is two-thirds of capacity; (c) when four feeders mesh, normal load is three quarters, and (d) when five feeders mesh, four-fifths. That is, case (b) makes 33 per cent, case (c) 50 per cent and case (d) 60 per cent more use of the feeder capacity than case (a). Or, assuming that the feeder capacity is 2,080 kva. in each case, then the regular working load will be 1,040 kva. for (a), 1,380 kva. for (b), 1,560 kva. for (c) and 1,660 kva. for (d).

Scheme 1 is shown diagrammatically in Fig. 1A and Scheme 2 in Fig. 1B, while the mains in the neighborhood of one feeder, except in the few cases where the mains connected to three or four feeders, instead of five, mesh, are similarly situated to every feeder, as shown in Fig. 2B.

Scheme 2 gives maximum economy of feeder copper when full provision is made for the failure of a substation, provided that the substations are remote from the load centers, which is the case in the present instance. From the diagram of the normal meshing of feeders and mains given in Fig. 2A, it will be seen that the mains connected to any one feeder mesh with the mains of feeders having their source in two different substations from the one to which the first mentioned feeder is to be connected.

On the assumption that complete provision is to be made for the shutting down of one substation, then the regular load of each feeder must not exceed 1,380 kva. and the system will become fully loaded in about three years. But if provision be made only for the failure of a feeder, the regular load of a feeder will be, on the average, 1,560 kva. and the system will become fully loaded in three and a half years, while in the event of the failure of a substation, the feeders affected will be overloaded to the extent of a maximum of 20 per cent. A comparison of the two schemes is given below.

Taking the load as a whole, the diversity factor is 0.65; taking the lighting load alone the diversity factor is 0.75, and taking the power load alone the factor is 0.5, and considering that in any one feeder the diversity may not be so low as it would be for the whole of the feeders taken together, a diversity factor of 0.7 has been assumed for the purpose of the following paragraph.

The sum of the loads of the services connected to one feeder, assuming full provision be made for the

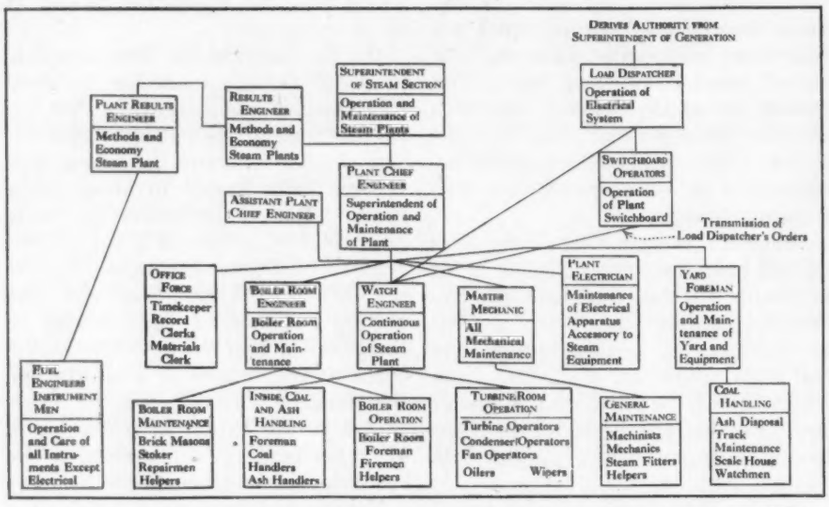
COMPARISON OF TWO DISTRIBUTION METHODS

Assuming complete provision be made for the failure of any one substation.

	Scheme 1	Scheme 2
Capacity of each feeder, kva....	2,080	2,080
Regular load of each feeder when fully loaded, kva.....	1,040	1,380
Regular load of thirty-three feeders when fully loaded, kva.....	34,300	45,600
System would be fully loaded in approximately, yr.....	2	3
Approximate cost of feeder cable.....	$227,000	$255,000
Approximate cost of feeders, mains, and service installations.....	$650,000	$680,000
Cost per kva. available:		
Feeder cable.....	$6.6	$5.6
Difference in favor of Scheme 2.....	.....	$1 = 18%
Feeders, mains and service installations.....	$19	$15
Difference in favor of Scheme 2.....	.....	$4 = 27%

Assuming provision be made only for the failure of a feeder.

	Scheme 1	Scheme 2
Capacity of each feeder, kva....	2,080	2,080
Regular load of each feeder when fully loaded, kva.:		
In peripheral areas.....	1,380	1,380
In semi-peripheral areas....	1,560	1,560
In central areas.....	1,660	1,660
Average.....	1,560	1,560
Regular load of thirty-three feeders, kva.....	51,500	51,500
System would be fully loaded in approximately, yr.....	3.5	3.5
Overload when substation fails, per cent.....	60	20
Approximate cost of feeder cable.....	$227,000	$255,000
Approximate cost of feeders, mains and service installations.....	$650,000	$680,000
Cost per kva. available:		
Feeder cable.....	$4.4	$5
Difference in favor of Scheme 1.....	$0.6 = 13%	....
Feeders, mains, and service installations.....	$12.6	$13.2
Difference in favor of Scheme 1.....	$0.6 = 5%	....


Derives Authority from Superintendent of Generation
Load Dispatcher
Operation of Electrical System
Superintendent of Steam Section
Operation and Maintenance of Steam Plants
Plant Results Engineer
Methods and Economy Steam Plant
Results Engineer
Methods and Economy Steam Plants
Switchboard Operators
Operation of Plant Switchboard
Plant Chief Engineer
Superintendent of Operation and Maintenance of Plant
Assistant Plant Chief Engineer
Transmission of Load Dispatcher's Orders
Office Force
Timekeeper Record Clerks Materials Clerk
Boiler Room Engineer
Boiler Room Operation and Maintenance
Watch Engineer
Continuous Operation of Steam Plant
Master Mechanic
All Mechanical Maintenance
Plant Electrician
Maintenance of Electrical Apparatus Accessory to Steam Equipment
Yard Foreman
Operation and Maintenance of Yard and Equipment
Fuel Engineers Instrument Men
Operation and Care of all Instruments Except Electrical
Boiler Room Maintenance
Brick Masons Stoker Repairmen Helpers
Inside, Coal and Ash Handling
Foreman Coal Handlers Ash Handlers
Boiler Room Operation
Boiler Room Foreman Firemen Helpers
Turbine Room Operation
Turbine Operators Condenser Operators Fan Operators Oilers Wipers
General Maintenance
Machinists Mechanics Steam Fitters Helpers
Coal Handling
Ash Disposal Track Maintenance Scale House Watchmen

WITH THIS CHART UNIFIED CONTROL IS OBTAINED BY THE OPERATING AND EFFICIENCY ENGINEERS REPORTING DIRECT TO THE SUPERINTENDENT OF STEAM POWER

failure of a substation, should not exceed (2080) × (1/0.7) × (1.33) or 4,000 kva. To make this clear see Fig. 2C, where *A* equals 1,000 kva.—which is the connected load regularly fed from 2, and in emergency from 1; *B* equals 1,000 kva. which is the connected load regularly fed from 1, and in emergency from 2; *C* equals 1,000 kva. which is the connected load regularly fed from 1, and in emergency from 3; and *D* equals 1,000 kva. which is the connected load regularly fed from 3, and in emergency from 1. Then, $B + C$ equals 2,000 kva. which is the regular connected load of 1 and $A + B + C$, or $B + C + D$ equals 3,000 kva., the emergency connected load of 1. Now, $3{,}000 \times 0.7 = 2{,}080$, the capacity of one feeder. Further, $A + B + C + D = 4{,}000$ kva. = the total connected load, that is the emergency connected load × 1.33. A corollary from the above is this: In order to make the best use of a feeder capacity, no one service should exceed 1,000 kva.

Operating a Steam Plant for Best Efficiency

IN THE operation of large power plants experience has shown that the best unified procedure is obtained where the efficiency engineers work in parallel with the operating men, but report direct to the superintendent of steam operation. By this method there is less chance of any conflict arising between the efficiency men and the plant engineer, who may not, perchance, be overly enthusiastic in having efficiency men, as he says, "mess up the place" and prevent good operation.

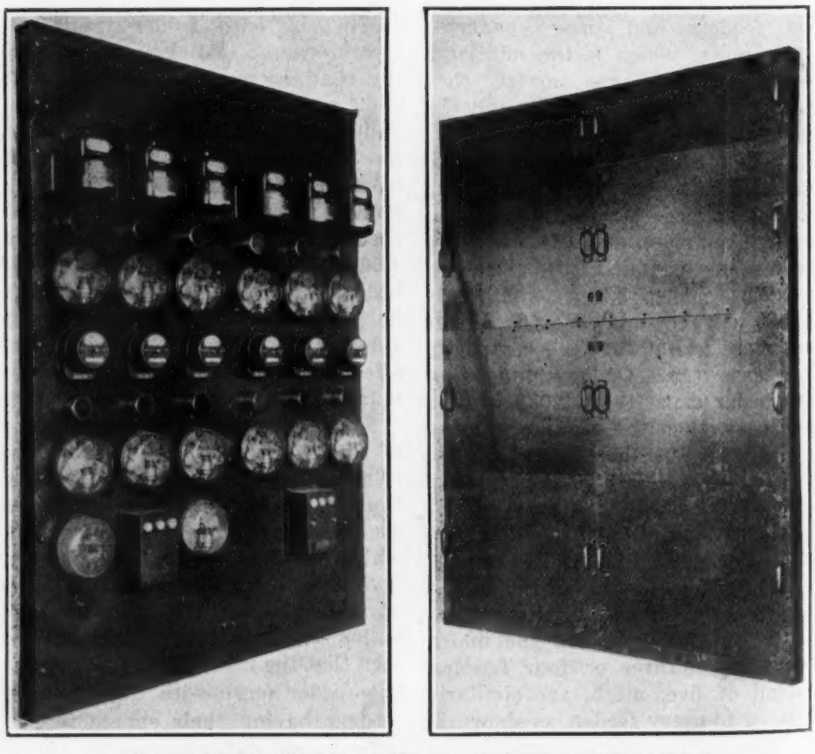
To avoid any such feeling the Northern States Power Company is segregating the employees of its Riverside plant, of 87,000 kw. capacity, in two sections. The staff directly responsible for the plant operation reports to the chief plant engineer, while the efficiency or results staff reports only to the superintendent of steam section. Thus any orders for checking operating results must come from him. This parallel control, leading directly up to the superintendent of steam distribution, has been very effective in segregating authority as well as operating the plant harmoniously.

Demand Metering Equipment

AN EXAMPLE of a very complete measured-demand metering equipment is given in the accompanying illustrations. These show the complete equipment necessary to measure the energy and reactive component and their respective demands on an installation of two three-phase, 13,200-volt feeders of the Philadelphia Electric Company supplying an industrial substation.

Meters involving demand indicators are checked by the maximum demand division of the electrical laboratory in order to avoid error in the operation, and as soon as such meters are installed or changed this division is notified by special form to check the demand-meter operation.

All construction work for these types of installations is done in the construction division machine shop, and the wiring and connections are made by the assembly section of the same division. This permits all jobs to be delivered ready for connection and makes a minimum amount of work necessary on the job, all of which assists in rendering quick and accurate service connection. The assembly section is used as an instruction school for apprentices, who after showing the proper aptitude are transferred to the construction forces in the field.



FRONT AND REAR VIEWS OF DEMAND METERING INSTALLATION

Central Station Business

Making Friends by Rapid Trouble Shooting

By Charles F. Stuart
Assistant to Vice-President and General Manager Northern States Power Company, Minneapolis, Minn.

FAR-SIGHTED public utility organizations are turning service troubles into friend builders. Generally speaking, there are three classes of "trouble shooting" services —poor, fair and excellent. A poor "trouble shooting" organization is a company liability, but fortunately this particular class has been on the decline for several years. When the lights go out in a customer's home, the washing machine blows a fuse or the range refuses to function and the company has no dependable trouble service for the customer to call upon, the situation naturally is aggravated. There is no possibility of turning this customer into a friend.

Companies which have fair trouble service organizations are more numerous than this first class. It may be the customer's habit to do the family washing on Monday morning. At 10 o'clock the fuse blows out and she sends a trouble call into the office of the electric company. The trouble man reaches her home late in the afternoon, or perhaps the next morning, and makes the necessary repairs. The customer has no complaint to make, especially if no charge is made for the service.

No Complaints, but No Company Boosters

A manager of a gas and electric utility giving fair trouble service in a city of 30,000 inhabitants once said: "Just ask around town about our trouble service and you will find the people have no complaints to make."

The manager was quite right. The people had no complaints to make. They felt that if a trouble call was made at 10 o'clock in the morning and attended to late in the afternoon, or made in the afternoon and attended to the next morning, they had no cause for complaint. But the point is that the manager of this property and managers of other properties having fair trouble service are not capitalizing trouble by turning trouble items into friends. The people in such communities are satisfied by, but not impressed with, this kind of trouble service. They are getting about what they expect, no more, no less. They are not complaining about it; but neither are they boosting for it.

The third class of service is the one which transforms trouble into friends. It is the one that changes a housewife, irritated over an interruption in her work, into a booster. It is the kind of service that finds the husband groping about in a dark house trying to locate a tallow candle and a match, and in a moment makes of him a booster for his electric company. This is the kind of trouble service the Northern States Power Company and the Minneapolis General Electric Company continually endeavor to give.

The company seeks to make its trouble service almost as speedy under ordinary circumstances as fire department service. If the family washing is interrupted at 10 o'clock on Monday morning by a blown-out fuse, the housewife pictures her whole week's program upset; but the trouble man comes "putt-putting" up in a Ford at 10:15, adjusts the trouble and hurries away with a "glad to have been of service" farewell. We find that we have not merely satisfied this customer, but have made of her a life-long booster. If the lights go out at 9 o'clock in the evening when there is a party on in the home and the host and hostess figure that the electric company has ruined the evening for them, we find that a trouble man bringing relief within twenty minutes leaves a party of boosters behind him.

Frank J. Gerlich is chief of the trouble-shooting organization of the Minneapolis division of the Northern States Power Company, and he and his men have made an enviable record in building good will. A follow-up postal card (described in the Electrical World, Feb. 2, 1924, page 244) is sent out to each customer after the trouble shooter has made his report. On this card the customer is asked to indicate what disposition was made of the complaint. A high percentage of the postal cards returned bear complimentary remarks.

An analysis of these returned postal cards reveals that promptness is the thing which impresses the customer. The words "prompt," "promptness" and "promptly" are to be found on nearly every card. While this kind of service cannot be maintained during general trouble caused by a storm, the company finds that under ordinary circumstances it is but little more expensive than poor service or fair service, and it certainly brings its return on the investment for it is the one kind of service that turns trouble calls into friends for the company.

All-Employee Stock Sale Exceeds Expectations

SUBSCRIPTIONS to 48,607 shares of stock were obtained in the all-employee sale of Commonwealth Edison Company capital stock just recently closed. Vice-Presidents John F. Gilchrist and Louis A. Ferguson have expressed great satisfaction with the results. The original allotment of stock was oversold by a substantial margin. While the number of new shareholders is not definitely known. It is estimated to exceed 5,000. Sales increased rapidly as the closing day approached, 2,000 to 3,000 shares being sold per day during the final week.

The names of 4,135 Edison employees were listed on the final honor roll indicating that more than 48 per cent sold at least one share of stock. The group of employees composing the purchasing, statistical, fuel, electric shop, bureau of co-operation and merchandise sales departments won high honors in the inter-council competition with a record of 93.21 per cent of the employees in its departments having scored at least one sale of stock. The group composed of the engineering and testing departments was second with a percentage of 82.62, and the substation and battery departments third with 81.38 per cent.

The operating department attained

first place with 14,239 shares to its credit. The street and power sales departments both exceeded 2,000 shares, with scores of 2,199 and 2,071 respectively. In all, sixteen of the employee teams exceeded the thousand mark.

During the Louis A. Ferguson drive, which continued from June 16 to July 7, the amount of stock sold totaled 26,717 shares. The men who sold the largest number of shares during this drive received autographed photographs of Vice-President Ferguson.

The regular Edison stock-selling organization steered the campaign, which was conducted under a plan recommended by a general joint council.

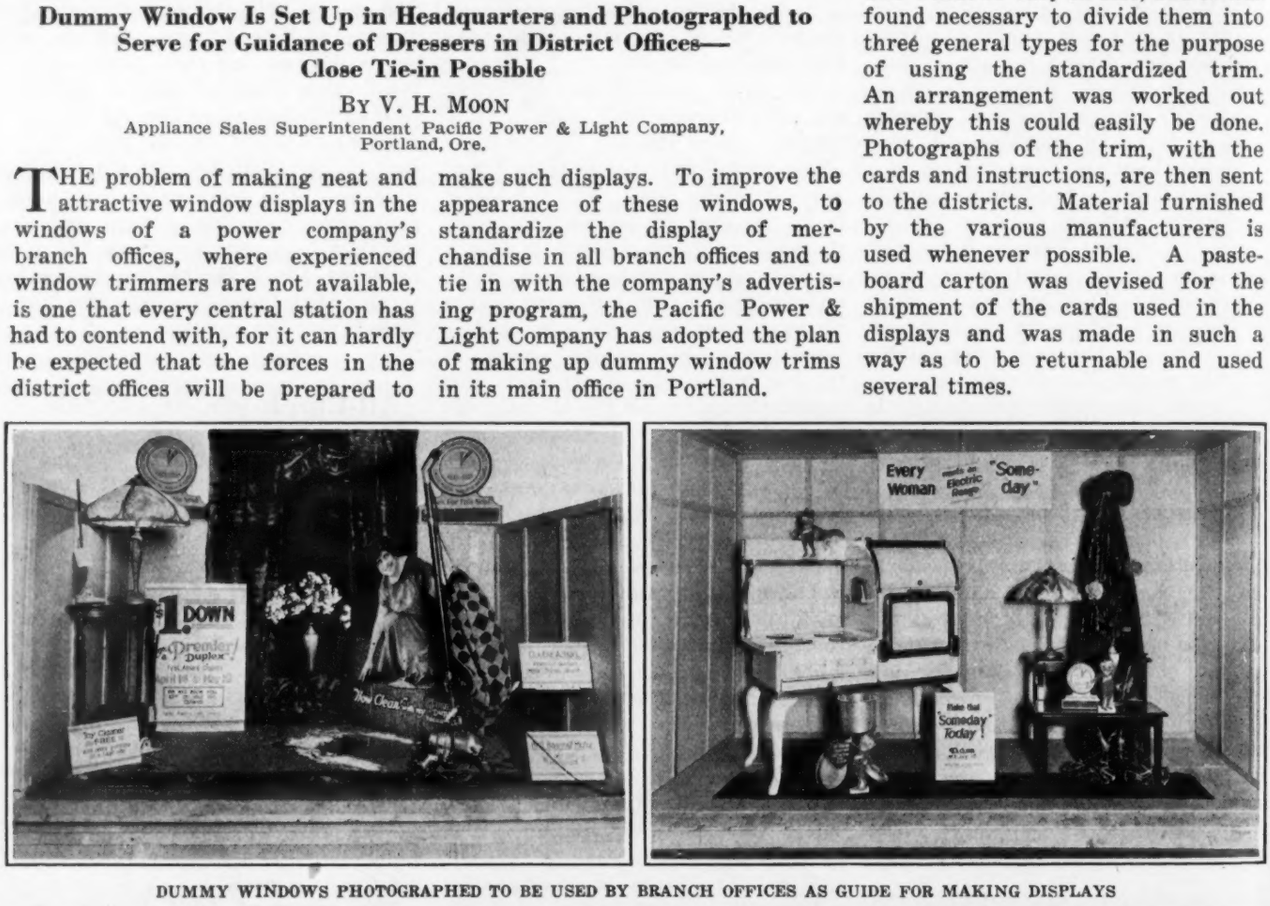
Window Trimming for Branch Offices

Dummy Window Is Set Up in Headquarters and Photographed to Serve for Guidance of Dressers in District Offices—Close Tie-in Possible

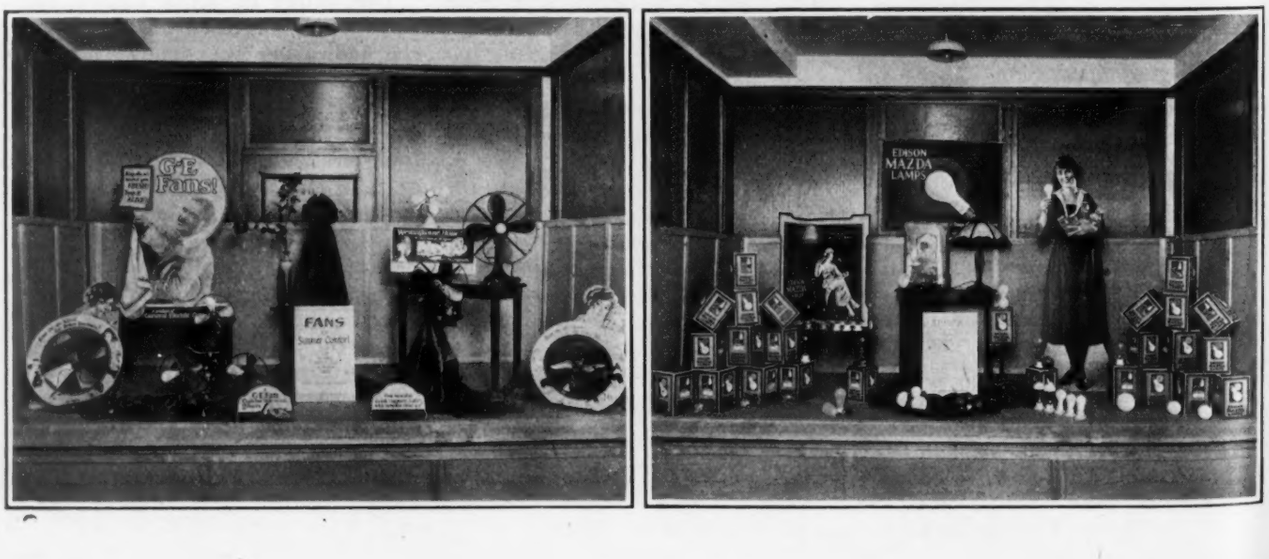
BY V. H. MOON
Appliance Sales Superintendent Pacific Power & Light Company, Portland, Ore.

THE problem of making neat and attractive window displays in the windows of a power company's branch offices, where experienced window trimmers are not available, is one that every central station has had to contend with, for it can hardly be expected that the forces in the district offices will be prepared to make such displays. To improve the appearance of these windows, to standardize the display of merchandise in all branch offices and to tie in with the company's advertising program, the Pacific Power & Light Company has adopted the plan of making up dummy window trims in its main office in Portland.

These are photographed as shown in the accompanying illustrations, and a picture is sent to each district office to be used as a guide in arranging its window display. Each office was furnished with a sufficient quantity of velours, window fixtures and decorative material to meet the space requirements of the display windows in the district. All materials were standardized, so that it is possible for each district to have the same display at the same time. The windows vary in size, and it was found necessary to divide them into three general types for the purpose of using the standardized trim. An arrangement was worked out whereby this could easily be done. Photographs of the trim, with the cards and instructions, are then sent to the districts. Material furnished by the various manufacturers is used whenever possible. A pasteboard carton was devised for the shipment of the cards used in the displays and was made in such a way as to be returnable and used several times.



DUMMY WINDOWS PHOTOGRAPHED TO BE USED BY BRANCH OFFICES AS GUIDE FOR MAKING DISPLAYS



The district offices have found this window-trimming service to be of considerable help, and the customers of the company have commented on the improved appearance of the windows since the inauguration of the plan. The plan has worked out very well, and the cost to the company amounts to less than $10 per month per district.

Combating Public Ownership in the Northwest

IN THEIR fight against the "Bone-Erickson bill," a public ownership measure proposed in the state of Washington, the power companies have combined through the medium of the Northwest Electric Light and Power Association to expose the insidious features of the bill and its consequent effect on taxpayers should it become a law. One of the most effective pieces of advertising used in the campaign represents a bill form or statement of account presented by the "Bone-Erickson Political Machine" to "Every taxpayer in the State of Washington," in the amount of $300,000,000, "to purchase, condemnation and construction, light and power properties."

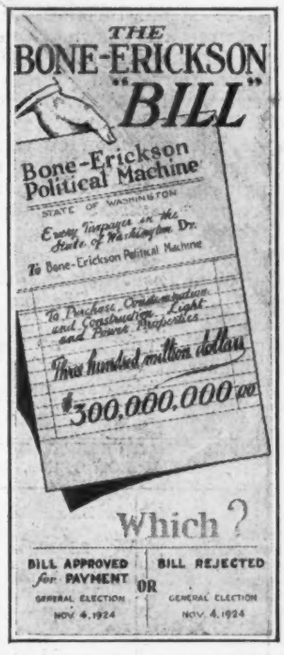
Following this an appeal is made to the average citizen stressing the matter of taxation. It starts out with a brief statement of the origin of the proposed bills and summarizes the most significant provisions as:

1. The power to levy unlimited taxes.
2. The power to issue general bonds, placing a mortgage upon all property in the state without a vote of the people.
3. The power to build up a state-wide political machine with no limit to the number of employees and no restrictions upon their salaries.
4. The right of the large cities to force this machine upon the smaller communities without their consent.
5. The power to manipulate this vast machine without regulation, and without restraint against discrimination, unjust charges, or inferior service.

Concerning taxes it says in part: "Seattle and King County have at the present time over $260,000,000 of tax-exempt property, of which over $61,000,000 is in municipally owned utilities. Not only have the taxes of the citizens of Seattle and King County been increased by taking this property from the tax rolls, but every taxpayer, every home owner, every farmer, in the state of Washington is paying, in increased taxes, for Seattle's experiments in municipal ownership." . . . "The Bone-Erickson 'free' power bill is traveling under a fraudulent label. The only thing 'free' about it is the power of the political machine to dip into the taxpayer's pocketbook. Nor does this bill contain any assurance of 'cheap power' to anybody."

The question of "cheap power" is summed up in the statement, "Cheap power results from well-conceived projects, wisely and economically developed and efficiently administered. Inaccurate engineering estimates, over-ambitious schemes and extravagant political management will inevitably result in higher, not lower, rates."

One of the chief arguments of those working for the measure is that the water powers are not owned by the power companies but belong to the people and should be developed for the benefit of every one.



FACSIMILE OF BILL SHOWING COST OF PUBLIC OWNERSHIP

To controvert this statement and show that that is exactly what the power companies are doing, with the highest degree of conservation the power companies say, "Initiative measure No. 52, the so-called Bone bill, does not contain one single provision which insures in the slightest degree the conservation of the water powers of the state in the interests of the people of the state. Its purpose is to allow Seattle and Tacoma still further to extend their experiments in municipal ownership—to use still more of the state's waters without compensation—to obtain an unregulated monopoly of the light and power business—to issue more tax-exempt bonds—to create still more tax-exempt property, and still further to increase the tax burden."

Taxpayers and voters of Washington are urged to "Read the Bone bill, study its provisions carefully, with particular reference to its effect upon your taxes when the present taxpaying properties are removed from the tax rolls." That these statements have been prepared by the Northwest Electric Light & Power Association is clearly stated on all information distributed on the subject.

Employees' Saving Fund Earns 26.4 per Cent

ALL employees of the Commonwealth Edison Company having a service record of one year or more are given the opportunity to participate in the employees' saving fund by depositing either 3 or 5 per cent of their salary as they may elect. On money so deposited the company pays 6 per cent compounded annually. When the principal plus interest is sufficient to buy Edison savings fund stock the money is so invested for the owner. On this dividends are also drawn.

Earnings of the fund for the present series amounted to 16.7 per cent. When interest allowed on deposit, plus the profit resulting from the difference between the price to subscribers and the present market price of stock, is added the average earnings have amounted to 26.4 per cent annually.

What Other Companies Are Doing

Davenport, Iowa.—The People's Light Company of this city has planned a series of advertisements designed to introduce its employees personally to the patrons. A picture and short sketch of the duties of each member of the staff will be published weekly in Davenport papers.

Alabama. — The Alabama Power Company conducted a cake baking contest in which the company's customers in 45 towns entered cakes to compete for a $225 electric range. There was no restriction upon what kind of stove the cakes should be baked, but it so happened that the winning cake was baked in an electric range. The method of conducting the contest and the results obtained by the company can be had by writing to F. P. Cummings, Alabama Power Company, Birmingham, Alabama.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Pulverized Fuel Systems.—A. L. COLE.—Many of the larger types of pulverizing mills now in general use, in the preparation of coal for burning in pulverized form in the boiler plant, have been used for a number of years in the cement and other industries. The developments during the last few years have been devoted principally to small or unit pulverizers for use in direct firing of boiler furnaces. A number of these plants are in the course of development. Various types of pulverizers are now in use in both the unit and multiple systems. The construction and operation of these pulverizers are described by the author in detail.—*Power*, June 10, 1924.

Affecting Power Plant Economy.—E. BERG.—Due to the rapid and ever-increasing price of fuel, central stations have, during the last year or two, done more toward obtaining station economy than at any previous time. The factors affecting power plant economy are discussed. Among these are the changes due by using high steam pressure, high superheat, combination of high steam pressure and superheat, steam extraction, reheating and the more efficient use of boiler economizers.—*Journal of Franklin Institute*, June, 1924.

Recent Developments in Hydro-electric Equipment.—W. M. WHITE.—The author presents some facts relating to recent developments in hydro-electric machinery such as that installed at the power house at Mitchell Dam for economically producing power from falling water. There are installed and now in operation at Mitchell Dam three waterwheels designed for a capacity of 24,000 hp. when operating under a head of 70 ft. and running at a speed of 100 r.p.m. Descriptions are given of the governor, automatic equipment, emergency stop device, remote control equipment and general operations of these units.—*Journal of A. I. E. E.*, June, 1924.

Generation, Control, Switching and Protection

High-Pressure Steam.—Realizing the decided advantages and economies in raising the steam pressures in boilers considerably above the heretofore common values, the society of German engineers devoted a meeting to this particular subject, which brought forth a great deal of new and valuable information from both theoretical men and manufacturers. The fourteen main papers presented by leading authorities on this subject, including the ensuing discussions, have been combined to a special issue of the *Zeitschrift des Vereines Deutscher Ingenieure*, and represent a volume of 104 pages with 253 illustrations. The influence of high-pressure steam operation makes itself felt in many branches of industries, such as, for example, boiler plate manufactures, rivets and rivet-setting, valves and other accessories, purification of boiler feed water, testing of materials, high temperature lubrication, etc. But of greatest importance are the changes brought about in the operation and the equipment of high-pressure steam plants from the viewpoint of heat economy. All these problems are dealt with in this elaborate symposium. Several manufacturers show their types of boilers for pressures of up to 100 atmospheres. A few sectional drawings of steam turbines for such high pressures are shown. Examples are given for the design of pipe lines, water separators and twenty-three high-pressure valves of various types. The book is probably the most complete and up-to-date collection on the relatively young branch of high-pressure steam engineering practice.—*Zeitschrift des Vereines Deutscher Ingenieure, Special High Pressure Steam Issue*, Summer, 1924.

High-Voltage Insulation of Bakelized Paper.—W. DEMUTH.—Modern constructions of high-voltage apparatus have demanded an insulating material with a number of very exacting properties both in electrical and mechanical respects. Thin paper, coated with Bakelite, and either pressed in many layers into flat plates, or rolled under heat and pressure over steel mandrels into the shape of cylinders, have found during the last few years a very extended use in electrical practice. The accompanying tabulation of data, comparing this material with porcelain and hard rubber, explains readily why Bakelized paper has become such an important factor in the design of high-voltage apparatus.—*Elektrotechnische Zeitschrift*, June 19, 1924.

COMPARISON OF MATERIAL FOR HIGH-VOLTAGE APPARATUS

	Bakelized Paper	Porcelain	Hard Rubber
Tensional strength	750 kg.-cm.²	240 kg.-cm.²	.....
Compression strength	2,500 kg.-cm.²	1,000-3,800 kg.-cm.²	.....
Bending strength	1,400 kg.-cm.²	400-500 kg.-cm.²	420 kg.-cm.²
Heat resistance	150-200 deg. C.	950 Deg. C.	40 deg. C.
Hygroscopy	Not weatherproof	Zero	Zero
Acid resistance	Safe for acids, salts and hot oil	Safe	Not safe for acids and oil
Fireproofness	None	Safe	None
Specific weight	1.35	2.35	1.75
Dielectric strength	20 kv./mm. Permanently 5 to 6 kv./mm.	10 kv./mm. Up to 2 million megohms	..... 1,000,000 megohms
Surface resistance	4,500 megohms	4.4 to 5.4	2 to 3
Dielectric constant	4 to 5		

Transmission, Substations and Distribution

Mechanical Calculations of Cables Composed of a Steel Core and an Aluminum Mantle.—O. STRAND.—The author deducts formulas and gives a series of diagrams for the determination of the stress distribution in steel-aluminum cables for different spans, different temperature ranges, etc. It is shown that the elastic limit of a cable of this kind is materially raised by permanent deflections during the mounting. These permanent sets do not affect the ultimate strength, however. This depends to a very marked degree upon the quality of the aluminum mantle, especially with reference to minute cracks in the metal.—*Teknisk Ukeblad* (*Norway*), June 3, 1924.

The 22,000-Kva. Transformers for the Niagara Falls Development.—F. F. BRAND.—During the past year the Niagara Falls Power Company has put into service the first unit of an extension which will contain the three largest water wheels and generators at present in the world, each generator having a maximum rating of 65,000 kva. at 12,000 volts and 25 cycles. Transformers for these new generators are being installed and will be single-phase, oil-immersed, water-cooled, rated at 22,000 kva., connected delta on the 12,000-volt side and in Y on the 39,500-volt side to give 68,500 volts Y. The salient features of these transformers are described.—*Journal of A.I.E.E.*, June, 1924.

Units, Measurements and Instruments

Electrical Registration of Height of Water.—J. DE GRAAFF HUNTER.—A device is described which can be fitted to a tide-predicting machine to record electrically on a chronograph the times at which successive prescribed heights of water are reached. The device may be found useful on other machines where vertical motion is recorded against time or other abscissa, as for example its use for measuring the height for water in hydro-electric plant reservoirs.—*Journal of Scientific Instruments*, May, 1924.

Electric Steel Testing Method.—B. KJERRMAN.—According to a method developed by B. D. Enlund in Sweden, the carbon component and the sum of solved impurities of steel and steel alloys may be very quickly determined during the refining process, or later on, by an electric resistance measurement, made on a small sample taken from the furnace. Casting the little sample to certain previously determined dimensions, it is quickly cooled in water and placed in a special clamping device. A certain current is then passed through it, and on a millivoltmeter the drop is measured for a standard distance. From tabulations and curves this gives directly the carbon content in per cent.

The test takes but two to two and one-half minutes. Subsequently mechanical tests may be made on the sample. The method has been introduced in several Swedish steel mills.—*Zeitschrift des Vereines Deutscher Ingenieure*, June 14, 1924.

Impulse Tests on Electric Insulators.—E. MARX.—Electric flashover and puncture tests made on insulators with very quickly rising potential (impulse tests) are much more severe than those made with commercial frequency alternating current. Atmospheric discharges and over-voltage troubles on overhead lines assume sometimes the character of such steep wave front potentials. In addition to the customary high-voltage test, all line insulators should therefore also be tested with impulse currents. The author gives a simple connection diagram according to which single or double impulse voltage may be obtained. The flashover with 50-cycle alternating current forms a long, flaring out arc, while the impulse flashover clings closely to the surface of the insulator. A great many insulators which have passed the former test will be punctured by the impulse test, but it will be found frequently that the puncture occurred through perfectly sound porcelain. A too high impulse voltage will cause therefore an unwarranted number of failures. It is suggested to give each insulator ten impulses, followed by the regular alternating-current test.—*Elektrotechnische Zeitschrift*, June 19, 1924.

Heat Applications and Material Handling

Emissive Tests of Paints for Decreasing or Increasing Heat Radiation from Surfaces.—W. W. COBLENTZ and C. W. HUGHES.—The authors describe experiments conducted for decreasing or increasing the rate of thermal radiation from heated surfaces. Data are given on the emissivity of sheet iron, cotton duck, roofing material, artificial leather, etc., covered with white paint, vitreous enamel, aluminum paint, etc. It was found that aluminum paint emits only 30 to 50 per cent as much thermal radiation as the unpainted material and as the white paint, vitreous glass enamel, or other non-metallic coatings. The application of these data to house radiators is discussed. It is shown that, owing to the fact that house radiators are essentially convectors of heat, a gain of only 10 to 15 per cent in heat dissipation into the room may be expected by covering the surface of the radiator with a paint which is free from flakes of metals, for example, aluminum or bronze.—*Technologic Paper No. 254 of the Bureau of Standards.*

Reaction between Steel and Performance of Welding Machine.—F. H. HELLMUTH.—It has been found that when pieces of steel of flat or cylindrical shape are being fed into a spot-welder, the current and consequently the energy consumption of the welding machine decrease in the measure as the steel is being fed deeper into the arms of the machines. With heavy steel pieces this may even become so pronounced that toward the end of the seam a very poor welding results. On a 15-kva. spotwelder the primary current for the first spot was 89 amp. for 4-mm. steel, which decreased to 62 amp. for the last spot at the end of a 600-mm. long seam. Investigations disclosed the appearance of an additional stray voltage, the magnitude and phase of which are solved vectorially. — *Elektrotechnische Zeitschrift*, June 19, 1924.

Electrophysics, Electrochemistry and Batteries

Ferromagnetism and Its Dependence Upon Chemical, Thermal and Mechanical Conditions.—L. W. MCKEEHAN.—Incomplete as the knowledge on the subject is, of both quantum and magnetic processes, it is not too soon to point out that in the application of magnetic fields is the only possible solution for testing the quantum theory of atomic structure in the solid state. In a theoretical treatment of ferromagnetism the author suggests ways of improving magnetic materials. Reversible and irreversible thermal effects, heat treatments, experimental comparisons, etc., are among the subjects treated.—*Journal of the Franklin Institute*, June, 1924.

Semi-Automatic Storage Battery Cell Switch.—V. CANDIE.—The French city of Nice has installed in its municipal power plant an unusual battery cell switch which maintains semi-automatically a constant potential of 200 volts. The battery has a capacity of 10,000 amp.-hr., and its cell switch is designed for a current of 5,000 amp. permanently, or 10,000 amp. for short duration. Consequently, the switch itself, with its fourteen main contacts, is extremely bulky. For example, each of these contacts weighs about 32 lb., the total length of the straight line switch is 9 ft., and weighs complete 2,800 lb. The traveling contact, moved by a 1.2-hp. motor and a long threaded spindle, carries eight main brushes and two auxiliary brushes, the latter preventing a short-circuiting of a cell while bridging two adjacent contacts. A 6,000-amp. breaker with remote control introduces a resistance between main and auxiliary brushes at that instant. A contact voltmeter sets the motor in operation whenever the voltage of the net falls below a certain value, which causes the addition of one or more cells until the normal potential is restored. Manual operation can be taken up at any time, shunting the automatic device.—*Revue Générale de l'Electricité*, June 21, 1924.

Permissible Storage-Battery Locomotives.—L. C. ILSLEY and H. B. BRONOT.—The Bureau of Mines has approved for use in gaseous and dusty mine atmospheres a 7-ton type "WOG," storage-battery locomotive manufactured by the Ironton Engine Company, Ironton, Ohio. This is the fourth locomotive to be approved by the Bureau. Each approved locomotive has a probable life of several years. During its life the locomotive may be operated in explosive atmospheres where failure of any of its safety features may involve the safety of every man in the mine. Therefore, as long as the approval plate remains on the locomotive the Bureau of Mines, as well as the manufacturer, is interested in the condition of the locomotive in all matters pertaining to its safety. Complete data on the investigations of this locomotive are given.—*Serial 2601 of the Bureau of Mines.*

Catalytic Electrolytic Generation of Oxygen.—C. G. FINK.—The author has in recent research work investigated the reactions taking place at the anode, anodic electrolytic corrosion and the development of insoluble anodes. The various classes of anodes and a discussion of the actual research work are given.—*Industrial and Engineering Chemistry*, June, 1924.

Telegraphy, Telephony, Radio and Signals

Analytical Discussion of Radio Circuits.—E. L. CHAFFEE.—An extremely theoretical discussion is given of the generation in coupled circuits. The simple theory of regeneration in a single oscillatory circuit is developed, both when the oscillatory element is in the plate circuit and in the grid circuit of the regenerating tube. The theory of coupled circuits having positive resistances is reviewed and illustrated by means of space models for the secondary current. The use of sections of the model for determining graphically and for visualizing the variations of secondary current as the primary or secondary circuits are changed or as the impressed wave length is varied is given. The theory of regeneration in coupled circuits is then developed. It is shown that regeneration in the secondary circuit affects only the impedance of that circuit and may make the equivalent resistance of that circuit zero or negative. Expressions are derived giving the relative selectivity of coupled circuits and a single circuit receiver, and curves are plotted giving the results in two numerical examples.—*Proceedings of the Institute of Radio Engineers*, June, 1924.

Miscellaneous

An Investigation of the Fatigue of Metals.—H. F. MOORE and T. M. JASPER.—This bulletin records the progress of an investigation of the fatigue of metals which was organized in 1919, and has been carried on at the University of Illinois in co-operation with the National Research Council, Engineering Foundation, and several manufacturing firms. Bulletin 124 contains the first report of the investigation and Bulletin 136 the second report. Many of the testing methods and much of the apparatus used in making the tests reported in this bulletin were the same as those employed in determining the results recorded in Bulletins 124 and 136, and descriptions of such methods and apparatus may be found in these bulletins. The main subjects considered in this bulletin are the theory of fatigue of metals, evidence of the existence of an endurance limit for wrought ferrous metals and of the improvement in strength of such metals by cycles of reversed stress at or below that limit, resistance to reversed axial stress, miscellaneous tests and test results and resistance to repeated stress other than reversed stress.—*Bulletin No. 142 of the Engineering Experiment Station of the University of Illinois.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rullings and News of Electrical Men

Northeastern Superpower

Hoover Committee Sees Possible Yearly Saving of 50,000,000 Tons of Coal —Looks to 1930

RENEWED recommendations for the construction and development of great interconnected steam and hydro-electric power projects throughout the Northeastern section of the United States, estimated to make possible a saving of 50,000,000 tons of coal annually, lower the cost of producing electric power and extend the use of electricity generally to farm areas, are contained in a report made public this week by the engineering sub-committee of the Northeastern superpower committee headed by Secretary Hoover.

The report covers the outstanding features of the superpower development long contemplated for the New England and Middle Atlantic States area and goes into technical questions involved in the plan of utilizing the sources of electrical energy as derived from both water and fuel and the probable demands that will exist in 1930.

The sub-committee, which included representatives of the public service commissions of the states most directly concerned and officials of the United States Geological Survey, the Federal Power Commission and the War Department, was appointed as the result of an informal conference Secretary Hoover held last October, with the consent of the President, with the chairmen of the state utilities commissions of the eleven Northeastern States. Its object was to make a systematic study of the legal and technical questions involved.

Coal to Produce 75 per Cent

Generation of electric power from coal, the report says, must be the principal dependence of the Northeastern area, because the maximum development of the water power will supply only 25 per cent of the needs of that section. To bring about efficiency in production and distribution, it recommends a practical interconnection of all the power centers, thus creating a vast electric power reservoir from which consumption centers might draw their exact needs, permitting any surplus to be used elsewhere.

The committee repeats the recommendations already familiar to the industry for the extension of interconnection, the building of large central steam plants at strategic points and the development of hydro-electricity, and it shows the beneficent results that will spring from such a program carried to its feasible extent. It is asserted that at present there is practical interconnection between only 8 per cent of the existing plants in the area surveyed, and to multiply such interconnecting lines would cut down the amount of reserve equipment necessary at producing plants and give a better average load factor than now exists.

The economic generation of power, the report continues, demands that it be produced in large plants of from 200,000 kw. to 500,000 kw., using generators of not less than 20,000 kw. each. Because such plants require a vast quantity of water their location, the committee asserts, would be restricted to the seaboard, the Great Lakes, the Ohio River and its tributaries and the Susquehanna River.

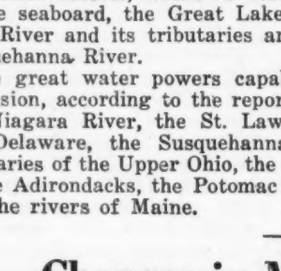
The great water powers capable of expansion, according to the report, are the Niagara River, the St. Lawrence, the Delaware, the Susquehanna, the tributaries of the Upper Ohio, the rivers of the Adirondacks, the Potomac River and the rivers of Maine.

Will of B. G. Lamme Provides Technical Scholarships

A trust fund of $15,000 is established by the will of the late B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, to provide two scholarships for the two most capable students in electrical and mechanical engineering respectively at the Ohio State University, Mr. Lamme's alma mater. A fund of $6,000 has also been established by the will for a gold medal to be awarded annually to a graduate of that university for meritorious achievements in engineering or technical arts. Another fund of the same amount is created to recognize the accomplishments of technical teachers. A third fund of $6,000 is to provide a medal for award by the A. I. E. E. to a member distinguished in developing electrical apparatus.

Changes in Middle West Utilities

Martin J. Insull Is Elected President, Samuel Insull Becomes Head of Board and Four New Vice-Presidencies Are Established



Martin J. Insull

SAMUEL INSULL has been elected to the new position of chairman of the Middle West Utilities Company, holding company for more than a score of the Insull properties. He has been succeeded as president by Martin J. Insull, his brother. The latter had been vice-president of the Middle West Utilities Company. Four additional vice-presidents were elected, E. V. Graham, who will be in charge of the sale of securities; W. C. Sharp, who will be in charge of operations; George W. Hamilton, who will be concerned with the hydraulic and engineering end of the company's business, and A. J. Authenreith, who will have the artificial ice engineering under his control. John F. Gilchrist continues as a vice-president. Samuel Insull, Jr., was recently elected a director of the company.

In making the announcement of the new officers Samuel Insull said: "It is a great personal pleasure for me to announce that my brother, Martin J. Insull, has been elected by the board of directors as president of the Middle West Utilities Company. This honor, in my judgment, is a fitting recognition of his invaluable work as vice-president of the company since its inception in 1912 and also of his high ability as displayed in his intimate relations to and participation in the management of such a vast and constantly growing institution."

Martin J. Insull, who has been vice-president, director and a member of the executive committee of the Middle West Utilities Company since its organization in 1912, served as president of the National Electric Light Association in 1920-21 and has been chairman of its public policy committee since that time. He was recently reappointed to the latter office by President Griffith.

The changes in the organization of the company have been caused by its great development, the gross revenue of $36,185,181 in 1923 being nearly ten times that in 1912. Samuel Insull will continue to take an active part in the management of the company.

Education, Not Selling

This Is to Be the Keynote of Better Home-Lighting Campaign—Steady Progress Made

THAT the national better home-lighting movement now under way in the electrical industry is primarily educational and not commercial in character is emphasized in a letter just sent by direction of the executive committee in charge of the campaign to the regional directors and others helping to make the movement a success. At a meeting of the executive committee held in New York City on Wednesday of this week Arthur Williams of the New York Edison Company was one of those who stressed the importance of absolutely divorcing the educational work of the home-lighting contest from any merchandising relation. The letter referred to is as follows:

"The Lighting Educational Committee feels that there is a possibility of the better home-lighting activity being endangered through its being presented on the one hand to the school authorities as a purely educational movement and on the other hand to the electrical trade as a business-producing campaign.

"This activity is first, foremost and all the time an educational movement. It is to conserve vision and promote the public welfare. It will inevitably have commercial consequences to the electrical trade because as home lighting is brought up to a higher standard it must mean the sale of more lighting equipment. It is in no sense derogatory to the educational aspect of the campaign that it should have this commercial consequence. It merely happens that there is a coincidence here between the public welfare and the welfare of the electrical industry. Every worth-while philanthropic enterprise will be found to have a commercial consequence.

"The point we must watch, however, is this: If in our letters, printed matter, etc., going to the electrical trade, we talk of the campaign in purely commercial terms, it will put us in the light of indulging in subterfuge with the educational authorities. We must talk in educational terms to the trade as well as the school authorities. We can point out this coincidence of public welfare with our own interests because the school authorities realize this too, but we must not solicit financial support or assistance on the basis that the movement will produce so much business. At this basis the activity is a genuine effort by the electrical industry to promote public welfare because it is a good thing for everybody, and we must see that it is always put forth in this light."

PROGRESS REPORTED

It was reported at the executive committee meeting that R. R. Young, commercial manager of the Public Service Company of New Jersey, had been appointed regional director for that state and that his company will participate actively in every town where it is represented.

Between one and a half and two million primers will be given to the school children in the fall. One hundred and thirty-one places in Ohio, Virginia, Kentucky and West Virginia have already decided to hold contests, In eighty-four of these properties are owned by the American Gas & Electric Company. The Union Gas & Electric Company, which operates in six cities in Ohio and Kentucky, and the Ohio Gas & Electric Company, operating in three cities in Ohio, will have contests. The Electrical League of Louisville, Ky., will conduct the campaign in that community.

General Gas & Electric Buys Columbia (S. C.) Utility

An announcement has just been made by the General Gas & Electric Corporation, a W. S. Barstow property, that it has concluded negotiations for the acquisition of the Columbia Railway, Gas & Electric Company of Columbia, S. C. The purchase carries with it the various subsidiaries—the Parr Shoals Power Company, Columbia Gas Company, Central Carolina Power Company and the South Carolina Power Company. It is expected that new generating equipment rated at 40,000 hp., half steam and half water power, will be added to the system.

Involved in the taking over of the Columbia company by the Barstow interests is the settlement of the Columbia Canal controversy, which has been in dispute between the state and the owners of the company since the latter was formed in 1887. The agreement, made with the State Canal Commission, must have the approval of the State Legislature before it becomes effective. It provides that the suit of the state started in 1917, to compel completion of the canal, shall be stopped and that the state shall not undertake independent development of the 500-water-horsepower interest retained in the canal, but will receive that equivalent from the company in electrical energy.

Commenting on the plans for additions and improvements to the plant and system of the Columbia company, W. S. Barstow, president of the General Gas & Electric Corporation, stated to a representative of the ELECTRICAL WORLD that his company would immediately proceed with the installation of new steam generating and distribution facilities to the extent of $3,700,000. "There is and has been for some time," said Mr. Barstow, "so serious a shortage of power that local industries have not been able to operate on a full-time basis, let alone enlarge their factories. In fact, some manufacturers have considered moving away from the territory served by the company. It is imperative, therefore, that additional generating capacity be provided at once.

"Further plans for new electrical construction in South Carolina will bring our total expenditures within the next few years to more than $10,000,000. A transmission line will be built between Columbia and Spartanburg, where we lately took over the gas and electric company. Spartanburg also is experiencing a power shortage. A new steam plant and an additional water-power plant will be constructed to take care of the present load and of new business."

Footballing Idaho Rates

Four Months After Establishing Tariff Commission Starts Proceedings to Reduce It

NOTWITHSTANDING the fact that rates for all classes of service rendered by the Idaho Power Company were fixed in March last by the Public Utilities Commission of Idaho and have therefore been in force only four months, an order has been issued by the commission requiring the company to show cause why lighting and power schedules should not be cut 10 per cent and why minimum charges for water-heating and auxiliary air-heating service should not be substantially reduced. The power company has responded by filing a bill of complaint, which names members of the commission and the State Attorney-General as defendants, in the United States District Court for Southern Idaho. In this bill of complaint the company asserts that the State of Idaho, by the commission's acts in undervaluing the company's properties, fixing a tariff of rates not sufficient to give an adequate return, and then harassing the utility by requiring it to defend itself against proposed further reductions, is virtually confiscating its property.

The rates promulgated in March were supposed to have brought to an end valuation and rate investigations involving the Idaho Power Company which have extended over a period of four years. Detailed inventories looking to a valuation of its properties were filed by the company in October, 1920. Hearings were held in the spring, summer and fall of 1921, but not until December, 1922, was the commission's decision entered. Further delays ensued, the rate case proper not being reached until November, 1923. The commission's rate order issued February 29, 1924, unified rates throughout the territory served, eliminated discriminations and, so it was believed, provided schedules which would give the company a return of about 7.3 per cent.

ONE COMMISSIONER DISSENTS

Monthly reports filed by the company and checked by both the commission's engineer and an out-of-state expert showed that revenues were not exceeding what the commission had contemplated, but, yielding to what is reported to have been political pressure, two members of the commission issued the recent "show cause" order. Commissioner F. C. Graves issued a dissenting opinion calling attention to alleged inconsistencies in the majority order, urging that the rates fixed in March were the result of mature, unhurried deliberation and closing with the following statement:

"If this commission, after years of work, is to establish its own set of rates one day and four months and a half later ask the company to show cause why the commission's own rates should not be reduced, without giving the said rates a fair trial, it is my firm conviction that it has forfeited any right to be considered seriously, except as a necessary stopping place on the way to the courts."

A contributory cause to the commission's action was a petition filed with

it by the Southern Idaho Light & Power Users' Association asking for a horizontal reduction of at least 10 per cent on all electrical rates now charged to consumers by the Idaho Power Company. In the case of irrigation rates the association asks an additional reduction of 10 per cent in order to place Idaho irrigation rates on the same level as rates in Oregon for similar service, for power generated in and transmitted out of Idaho. The petitioners maintain that changing conditions have worked to the customers' disadvantage since rates were last fixed.

The action brought by the company in the federal court did not prevent the new hearing being proceeded with by the commission, and a reply opposing the suggested reduction was filed by the company at the commission's office in Boise last week.

Fishery Interests Fight Water Power

Federal Power Commission, However, Grants Preliminary Permit for Klamath River Development—Plant with Rating of 125,000 Hp. Planned on This Stream

IN AUTHORIZING a preliminary permit for the Electrometals Company, covering an important development on the Klamath River in northwestern California, the Federal Power Commission has given a significant indication of its attitude toward protests against high dams by fishery interests. The preliminary permit was authorized in this instance over unusually strenuous protests from the California Fish and Game Commission and from Representative Raker of that state. It is the opinion of the commission, however, that the problem of passing fish over high dams can be solved. It is believed that this problem can be worked out during the time it is necessary for the surveys of the project, the preparation of plans and the perfection of financial arrangements. The effect in this instance is to allow the preliminary work to go ahead on a project which promises much for northern California and for the country as a whole.

The Electrometals project covers two dams in the Klamath River at which 127,000 hp. can be developed, and the expenditure is put at $15,000,000. The application is made jointly, however, with one by A. P. Seybold, which provides for a third dam at which 30,000 hp. can be developed. These applications were filed nearly four years ago. The development of cheap power on the Klamath is the basis for an important project for manufacturing aluminum at Trinidad, a port on the Pacific just north of Eureka.

Long Fight Waged

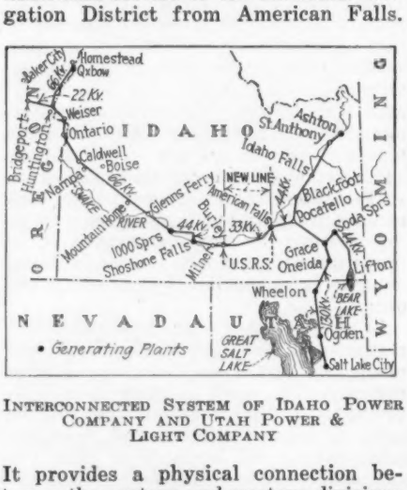
For two years an intensive controversy over this project has raged in California. A thorough study of the proposed development by the division of water rights of the Department of Public Works of California resulted in a decision to grant the necessary state rights for this project. The Fish and Game Commission has carried the matter to the courts, but the Federal Power Commission saw no reason to withhold the preliminary permit after the state rights had been granted.

Representative Raker at the last session of Congress proposed an amendment to the water-power act which would remove the Klamath River from the jurisdiction of the commission. The House committee acted adversely on the Raker bill. A similar measure was lost in the California Legislature when the Senate committee voted it down 14 to 1. The Fish Commission then began circulating a petition to have the Klamath River made a state fish preserve on which no developments could be made. The proposal is to put the question to the people at the November election as an initiative and referendum measure, and 130,000 signatures have been obtained.

The Electrometals Company has submitted a large amount of evidence intended to show that fishways can be built which will allow the passage of salmon. While the commission is fully aware of the much greater value of the power possibilities of such streams as the Klamath and the Columbia Rivers as compared with the value which they have to the fish industry, there is no disposition to interfere with the migrations of salmon.

Another Gap Closed in Western Transmission Lines

With the completion in July of a 33,000-volt transmission line from American Falls, Idaho, to a point near Burley, Idaho, another connecting link has been added to the already extensively interconnected transmission system of the West. The line is 45 miles in length and was built by the United States Reclamation Service to supply additional service to the Minidoka Irrigation District from American Falls.



INTERCONNECTED SYSTEM OF IDAHO POWER COMPANY AND UTAH POWER & LIGHT COMPANY

It provides a physical connection between the eastern and western divisions of the Idaho Power Company and a continuous transmission system of more than 500 miles extending from Homestead, Ore., to Salt Lake City, Utah.

Many New York State Electrical Companies "Dead"

About two hundred central-station and electrical manufacturing companies in the State of New York have been officially proclaimed "dead" by the Governor in accordance with a law passed by the Legislature in 1922, the intent of which was to eliminate from the records of the corporation bureau in the office of the Secretary of State at Albany the names of corporations no longer in existence. By the terms of this act every stock corporation formed before January 1, 1898, except corporations which had paid a franchise tax subsequent to January 1, 1919, corporations formed by special act and banking, insurance, transportation and railroad corporations, was required to file a certificate with the Secretary of State before December 31, 1922, showing that it was still alive. In April of this year the names of companies concerned which had not filed such certificates were published in newspapers in the respective counties where these companies were organized, and three months' grace was extended during which they could on payment of a fee of $25 be reinstated as still existent.

The inconspicuous method of publication employed under the law has led in some branches of industry to the official dissolution of many companies without their knowledge, and in these cases special legislation will be necessary next winter if they are to retain their name and corporate existence. Although most of the electric companies listed undoubtedly no longer exist under the name advertised, there may be cases where the law has not come to the attention of companies that are affected. Where doubt exists the Department of State at Albany should be consulted.

Southern California Edison Adds Steam Equipment

The Southern California Edison Company, in an effort to meet the emergency caused by the water shortage in California, has placed in service a total of 26,620 hp. in steam capacity in the form of small or obsolete plants which have been leased from industrials in southern California. In addition one 13,000-hp. turbine has been purchased and installed in record time in the Long Beach steam plant and two 6,500-hp. turbines which were supplied by Eastern manufacturers were placed on the line on July 15. Work is pro-

INDUSTRIAL PLANTS LEASED TO MEET EMERGENCY

	Hp.
Pacific Electric Railway:	
Vineyard substation plant....	4,600
Sixth and central plant.....	13,000
Anaheim Sugar Company.....	660
Huntington Beach Sugar Co....	660
Santa Ana Sugar Company....	400
Los Alamitos Sugar Company.	660
Monolith Cement Company....	1,300
Union Tool Company, Torrence.	660
Sugar Pine Lumber Company.	2,600
Standard Oil Company, Whittier	400
City of Riverside plant.....	530
Chino Sugar Company.....	820
Oxnard Sugar Company.....	330
Total	26,620

gressing rapidly on the Long Beach No. 2 steam plant, which will have a capacity of 93,000 hp., and which will probably be in operation by the first of next year.

Neither of two plants which have been leased from the Pacific Electric Company has been in operation for ten years. In addition energy is being purchased from the following: Los Angeles Gas & Electric Corporation, 33,000 hp.; city of Pasadena, 13,000 hp.; San Diego Consolidated Gas & Electric Company, 5,300 hp.—totaling 51,300 hp.

A contract has been made with the San Joaquin Light & Power Corporation, Fresno, to deliver 16,500 hp. commencing August 1. Further relief will also be had through an arrangement whereby the Pacific Gas & Electric Company and the Great Western Power Company will divert their excess power to southern California in order to relieve the power shortage caused by drought conditions there. This plan has been approved by the State Railroad Commission.

The power will be relayed over the transmission systems of the Coast Valley Gas & Electric Company and the San Joaquin Light & Power Corporation, and will be turned into the distributing system of the Southern California Edison Company and other power systems in the southern part of the state.

The arrangement is under the direction of Harry G. Butler, state power administrator.

Licenses Granted in Three States

Santee and Chattahoochee Projects Are Among Those Authorized by Federal Power Commission—Mokelumne and Green River Applications—Preliminary Permits Issued

THE Federal Power Commission has authorized the issuance of a license to the Columbia Railway & Navigation Company, to which a preliminary permit was issued on September 20, 1921, covering the project on the Santee and Cooper Rivers in South Carolina. The project contemplates the construction of a diversion dam in the Santee River at Ferguson, the digging of a 14-mile canal easterly into the basin at the head of Cooper River, the construction of three or more earthen dams to create an equalizing reservoir, and the construction of a power house and tailrace discharging into Cooper River at a point 25 miles above Charleston.

The development will be made in two stages. In the first stage the water will be impounded to a level of 55 ft. above sea level, and in the second stage the dams will be raised 10 ft. It is estimated that 42,000 hp. can be developed initially and that the ultimate stage will develop 122,000 hp. The canal will follow the route of a pre-Revolutionary navigation canal. When locks are provided, it will shorten the water route from Columbia to Charleston by 75 miles. The license will require the applicants to construct a lock in the diversion dam at Ferguson, and that a discharge at that point be permitted so as to maintain a depth of 6 ft. in the Santee below the diversion dam.

A license has also been authorized in the case of the Minnesota Power & Light Company covering a project on the Kawishiwi River in northern Minnesota. This is an existing project of 5,400 hp. A federal license became necessary when the chief of engineers ruled that the Kawishiwi is a navigable stream.

A license has also been authorized for the Columbus Electric & Power Company covering the proposed project in the Chattahoochee River at Bartlett's Ferry, 8 miles above Columbus, Ga. The company has complied with the conditions in the preliminary permit issued to it previously.

The license issued to the Excelsior Water & Power Company for its Yuba River project in California on March 24, 1924, has been extended so that the maximum period is twenty-five years instead of ten years. This change was authorized when the company advised the commission that it would be unable to finance the project unless the term were extended.

Preliminary Permits Granted

A preliminary permit has been granted by the Federal Power Commission to the city of Sacramento which will permit diverting the upper tributaries of the Rubicon River into Silver Creek, a tributary of the South Fork of the American River, in order to develop power in Silver Creek and to carry this water from the mouth of Silver Creek through a conduit to Sacramento for water supply and for irrigation purposes in the vicinity of the city. The California Power Board recommends that the Rubicon should not be diverted out of its own basin but should be developed in its natural course. The preliminary permit will require the city of Sacramento to make that alteration in its plans.

A preliminary permit has been authorized for the Pike Rapids Power Company of Duluth, covering a power project on the Mississippi River, 10 miles down stream from its Blanchard Rapids development and at the head of the pool of the Watav development. The Blanchard Rapids project is under construction. There is a 22-ft. drop between the Blanchard Rapids dam and the Watav pool, which will permit of the installation of equipment sufficient to generate 10,000 additional horsepower.

The preliminary permit held by R. W. Hawley on Silver Creek in California has been canceled. The preliminary permit of Kehoe, Hanson, Hummel and Sutherland, covering a project on Thumb Creek in Alaska, also has been canceled.

Jurisdiction Decisions

The Federal Power Commission has taken jurisdiction over the North Fork of the Kentucky River, where W. J. Loughbridge and E. T. Gunn of Lexington propose to construct a dam 100 ft. high. The chief of engineers has reported that this dam will affect the navigable capacity of the lower portion of the river.

The commission finds that it is without jurisdiction over a proposed project in the Androscoggin River in New Hampshire, where the Dummer Power Company of Concord proposes to construct a dam 22 ft. high at a point near Pontoocook Falls. The stream is used for floating out logs, but the chief of engineers reports that the state laws amply protect the logging interests.

Since the proposed project of the Puget Sound Power & Light Company of Seattle on Baker River does not affect navigation, the chief of engineers has recommended that no jurisdiction be taken by the commission. Baker River is a tributary of Skagit River, which flows into Puget Sound near Bellingham.

Mokelumne and Green Rivers

Despite the lack of reservoir sites on the Mokelumne River in California, Stephen E. Kieffer of San Francisco believes that at one point on the river a large reservoir can be operated successfully, thereby saving a portion of the run-off of that stream. His plans, which have been filed with the commission, together with his application for a preliminary permit, call for a high dam in the river which will divert the water into a large basin on Dry Creek. The Mokelumne River was considered by the city of San Francisco in connection with its water-supply problem, but was rejected in favor of the Hetch Hetchy project. At the present time the East Bay cities are considering the Mokelumne River in connection with the study of their water-supply resources.

There is no disposition on the part of the Utah Power & Light Company to press its Green River application at this time, it is understood. The company recognizes that any effort to alter the determination of the commission to hold up all applications involving the Colorado basin could only have the effect of precipitating an acrimonious controversy. There is a feeling that development of the Colorado cannot be held up indefinitely, but in so far as the Utah company is concerned the present is not regarded as a propitious time to agitate the matter.

Applications Filed

Eight applications for licenses under the federal water-power act were filed with the commission during the five-week period ended July 12, 1924, making the total received to that date 516:

No. 509. The A. & P. Products Corporation has applied for a license for a small constructed power project, with a capacity of 40 hp., on Waterfall Creek, in the Tongass National Forest, near Hyder, Alaska.

No. 510. The Washington Water Power Company has applied for a license for a 24-mile transmission line along the Great Northern Railroad, from Neppel, in Grant County, to Taunton, in Adams County, Washington.

No. 511. Charles D. Carter and B. B. Smith have applied for a preliminary permit for a 200-hp. project on Thumb Creek, in the mining district near Hyder, Alaska.

No. 512. The El Dorado Power Company, a subsidiary of the Western States Gas & Electric Company, has applied for a preliminary permit to divert 250 cu.ft. per

second of water from the Silver Fork of South Fork of American River, in El Dorado County, Cal., for the development of power in connection with the company's construction project which now utilizes the old El Dorado mining ditch.

No. 513. Yael Rosenstain and Malcolm Smith have applied for a preliminary permit for a small power project on Bonanza and Canyon Creeks, in the Hyder mining district, Alaska.

No. 514. Stephen E. Kieffer has applied for a preliminary permit for a proposed development on Cosumnes River in Amador and El Dorado Counties, Cal. Mr. Kieffer proposes to build a dam 285 ft. high, storing 400,000 acre-feet, to divert the flood waters into the proposed Arroyo Seco Reservoir on Dry Creek, near the town of Ione, where the water will be used for irrigation, domestic and mining purposes for lands and towns in the Sacramento Valley lying west of the dam site. A power house will be installed at the base of the dam in the Cosumnes River to utilize the flow which must be permitted to continue in the present channel because of existing water rights lower down the river.

No. 515. The Cascade Electric Company has applied for a preliminary permit for a comprehensive project on Salmon River and its tributaries, in Clackamas County, Ore. This is a project which Joseph R. Keep has been endeavoring for many years to promote. He has recently incorporated a company, which has made the application. The plans show that many miles of tunnels and canals will be required in the development.

No. 516. The Lexington Water Power Company has applied for a license to construct a power dam about 100 ft. high in the Saluda River, at a point about a quarter of a mile below the mouth of Bear Creek, near Lexington, S. C. A reservoir storing 12,000,000,000 cu.ft. of water will be created. The power house at the dam will contain four units of electrical equipment, with a total capacity of 45,000 hp.

Another Tippecanoe River Power Project

Development of a new water-power project at Oakdale, on the Tippecanoe River, about 10 miles below the site where the Norway water-power project, the first of the kind in Indiana, recently was completed, is to be started within sixty days by the Indiana Hydro-Electric Company. The officers of the Hydro-Electric company are officers of the Interstate Public Service Company, in which a controlling interest has been obtained by the Middle West Utilities Company. Another site on the Tippecanoe is owned at Springboro.

The new plant, consisting of a dam and power station, will cost, when entirely completed, about $2,000,000. It will be larger than the Norway plant and will be operated by the Interstate Public Service Company. Surveys for the new project have been completed and work preliminary to actual construction now is proceeding. The engineering work is being done by Roger M. Freeman of New York. The plant will have a 42-ft. operating head as compared with a 30-ft. operating head for the Norway dam, and the power plant will have an approximate capacity of 14,000 kw., while the Norway plant has 8,500 kw. The plant will transmit electric power to Lafayette, Ind., and will connect with the Goshen-Warsaw system, which supplies the Winona Service Company with light and power for operation of the Winona interurban line and other utilities using power in that section of the state. Harry Reid, president of the Interstate and the Indiana Hydro-Electric, also is president of the Winona Service Company, which recently was reorganized by Mr. Reid, James P. Goodrich, former Governor of Indiana, and others.

Financial and Corporate

Market Turns Quiet

Utility Gains Still Predominate, However, as Committee Reports on Superpower

THAT the quickened interest last week in railroad and industrial stocks, stimulated in part by the ease in money and the rise in agricultural prices, has failed to enliven the utility market is not so strange. Transactions in utility stocks, it should be borne in mind, are not like transactions in rails and industrials. Relatively few utility issues are listed on the New York Stock Exchange, to begin with, and trading in them has not been so predominatingly speculative in character as in other departments. Not being generally available to margin traders, that is, the utility stocks are not picked usually by the speculator who plays for quick and unimportant turns either on the long or the short side. That is why temporary changes in conditions for which the market traders on the big board have an eye open do not greatly affect values in the power and light field.

Indeed, it is a tribute to the stability of the industry's securities that, in the presence of the recent speculation elsewhere, the utility issues have simply turned steadier. Earlier in the year, when other groups were sagging on reports of poorer business ahead, the utility stocks were reaching forward briskly to new highs. And, while a few issues lost ground last week and trading was dull, the general trend was still upward. Commonwealth Power Corporation's common stock, on the report that earnings after a liberal allowance for depreciation aggregated $13.04 per share for the twelve months ended June 30, 1924, rose. Stock of the Middle West Utilities Company, the large Insull holding organization, went up four points as investors took greater interest in the results promised by the Insull superpower development. Eastern Texas Electric, a company with a funded debt smaller than its gross earnings, has been under accumulation by investors. Galveston-Houston Electric, which does part of the light and power business in Galveston, touched a new level equivalent to three times that at which the stock sold earlier in the year. American Water Works & Electric, which had fallen from 115 to 90, rallied about as quickly from 90 to 109. Another good gainer was American Public Utilities. Announcement of the final adoption of the plan for a new capital set-up by the Public Service Corporation of New Jersey, by which the corporation has modernized an old-fashioned structure in an interesting manner, had no effect upon the stock, but the general mortgage bonds turned active and strong.

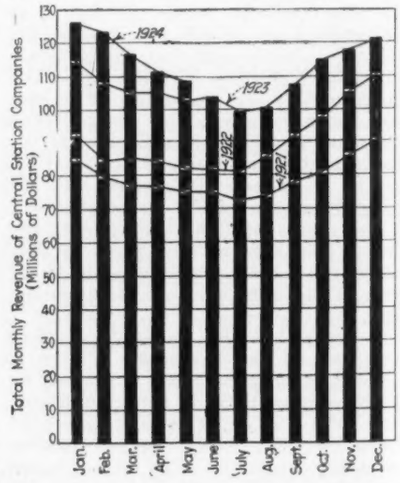
The report of the Northeast superpower committee under the general direction of Secretary Hoover was a document that, although pretty well discounted in the market, aroused wide interest. The report covers almost everything in the plan from Maine to West Virginia and Maryland and contemplates an annual saving of 50,000,000 tons of coal through interconnections. Such possibilities were already known by the industry, but will tend to stimulate a more active interest on the part of consumers and investors in the industry and its securities.

Cities Service Company Buys Three New Systems

Henry L. Doherty & Company announced this week the acquisition for the Cities Service Company of the Sandusky Gas & Electric Company, the Northwestern Ohio Railway & Power Company and the Port Clinton Electric Light & Power Company. The three companies will form a connecting link between two of the most important subsidiaries of the Cities Service Company, the Toledo Edison Company and the Ohio Public Service Company. A recent valuation of these properties, which have been in the control of the General Gas & Electric Corporation heretofore, exceeded $7,000,000.

Annual Growth in Gross Revenue Decreases

Regular monthly reports of central-station operations received by the ELECTRICAL WORLD indicate that the total gross revenue from the sale of energy during May totaled $108,200,000, a daily average of $3,490,000. This



FOUR YEARS' GROWTH IN GROSS REVENUE OF CENTRAL STATIONS

is an increase of 8.2 per cent over May of 1923. The total gross revenue for the first five months of the year totaled $459,060,000 against $417,000,000 for the same period last year, a gain of 10.3 per cent. The operating expenses during May totaled $49,300,000, a gain of 8.0 per cent over May of last year.

GROSS CENTRAL-STATION REVENUE IN MAY

States	1924	1923	Per Cent Gain
New England	$9,675,000	$9,360,000	3.4
Atlantic	41,414,000	37,715,000	9.8
North Central	34,614,000	32,685,000	5.9
South Central	8,477,000	7,570,000	12.0
Mountain and Pacific	14,020,000	12,670,000	10.7
United States	$108,200,000	$100,000,000	8.2

The central-station companies of the South Central States reported the largest percentage gain in revenue over last year, with the Mountain and Pacific States second. The New England States reported an increase of only 3.4 per cent in revenue over last year. The central-station gross revenue for May is given in the table.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the seven-day period ended July 29:

Name of Company	Per Cent	When Payable
ntral Arizona Light & Power, pf	2	Aug. 15
Central Arizona Light & Power, com	3	Aug. 15
Cumberland County Power & Light, pf	1½	Aug. 1
Eastern Shore Gas & Electric, pf	2	Sept. 1
Illuminating & Power Securities, com.	45c.	Aug. 9
Illuminating & Power Securities, pf	1¾	Aug. 15
Pacific Gas & Electric, pf	1½	Aug. 15
Pacific Lighting, com	4	Aug. 15
Pacific Lighting, pf	1¾	Aug. 15
Western States Gas & Electric, pf	1¼	July 15
Fairbanks-Morse, com	65c.	Sept. 30
Fairbanks-Morse, pf	1¾	Sept. 1
Worthington Pump & Machy., pf. A	1¾	Oct. 1
Worthington Pump & Machy., pf. B	1¾	Oct. 1

Company Reports

Among the company reports issued during the past week for the month of June are the following:

Name of Company	Gross Revenues for June 1924	Gross Revenues for June 1923
Asheville Power & Light	$84,375	$79,924
Carolina Power & Light	194,840	178,489
City of Tacoma (Light Dept.)	106,011	109,001
Columbia Gas & Electric subsidiaries	1,656,551	1,485,120
Commonwealth Power and subsidiaries	2,361,213	2,292,941
East Penn Electric	243,320	228,936
Georgia Railway & Power	1,291,823	1,332,814
Great Western Power	627,830	584,682
Idaho Power	249,837	226,470
Indiana Power	89,636	87,555
Manchester Traction, Light & Power and subsidiaries	196,991	202,992
Newport News & Hampton Railway, Gas & Electric	176,116	189,373
Philadelphia Company	2,808,472	2,783,847
Southern Canada Power, Ltd., and subsidiaries	81,986	75,370
Tennessee Electric Power	755,197	733,916
United Gas & Electric	1,142,935	1,082,080
Utah Power & Light	708,777	661,890
Washington Water Power	417,445	402,472
Yadkin River Power	144,275	158,693

New Merger in Ohio

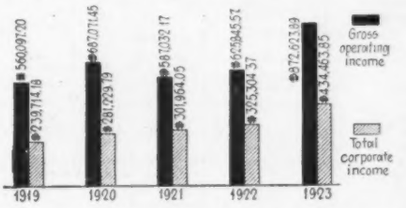
A new company to be known as the Ohio Electric Power Company has been organized in Ohio through the acquisition of the properties of the Oberlin Gas & Electric Company and the Ravenna Gas & Electric Light Company. The companies combining to form the consolidation supply electric light, power and gas in the city of Oberlin and electric light and power in the towns of Ravenna and Mantua and in other territory in Portage County, adjacent to Ravenna. The new organization has just issued, subject to the authorization of the Ohio Public Utilities Commission, $750,000 in first mortgage 6½ per cent sinking-fund gold bonds, which will be secured by a direct first mortgage upon the entire fixed property to be acquired by the company. Upon the completion of the present financing there will be outstanding, in addition to the $750,000 in bonds, $150,000 in 7 per cent cumulative preferred stock and 2,000 shares of common stock of no par value. The properties acquired in the formation of the Ohio Electric Power Company are operated and managed by the Albert Emanuel Company, Inc., and report consolidated gross earnings for the twelve-month period ended May 31, 1924, amounting to $315,788.

Arizona Power Company's New Structure

How a Utility in the West, Faced with an Accumulation of $78 per Share on Its Preferred Stock, Has Cleared the Way for Junior Financing

BY PAUL WILLARD GARRETT

THE Arizona Power Company operates in the state that bears its name, serving such places as Prescott, but, having been incorporated in Maine, its official meeting place is Portland in the latter state. A meeting of the stockholders was held last week. Although no stockholders actually traveled up to Portland, they did, through the counselor who voted the proxies, perform an uncommonly interesting job. They approved a plan by which President F. S. Viele, long handicapped by large dividend accumulations on the preferred stock, may be able to do some junior financing.



COMPARISON BETWEEN GROSS OPERATING REVENUE AND TOTAL CORPORATE INCOME OF ARIZONA POWER COMPANY

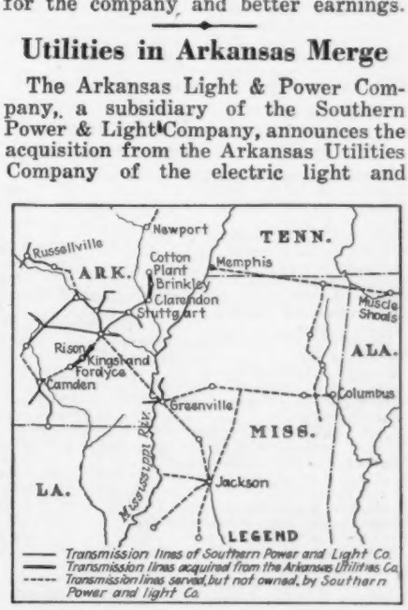
As was pointed out in the ELECTRICAL WORLD two weeks ago, the large companies all have in one way or another cleared away their accumulations on the preferred issues. None remains unpaid. None, that is, of the 116 companies that represent perhaps 90 per cent of the capitalization of all electric light and power companies operating in this country. But the small companies that represent the other 10 per cent far outnumber the big ones, and it is with these numerous small companies that Arizona Power belongs. Not all of these have wiped out the accumulations on their preferred issues. Arizona Power for one has not been able heretofore to carry on any satisfactory financing program on account of the large accumulations still unpaid. A share of Arizona Power preferred could have been purchased earlier in the year at $40, or last year at $24, yet the back accumulations alone by November 1, 1924, will aggregate $78 on each share. To pay off the amount in cash would, of course, simply break the company's back.

The stockholders by a handsome vote now have indorsed a plan for junior financing, one step of which involves the voluntary surrender of the old stock. First, they have authorized the directors, at their discretion, to issue $1,000,000 of new 8 per cent cumulative preferred stock to have preference over all other stocks. This issue would be offered to the public when new junior financing is undertaken. Second, they have authorized $1,000,000 of new 7 per cent preferred cumulative from July 1, 1924, and to be issued by the directors only in exchange for the present 6 per cent preferred. The new 7 per cent preferred would rank ahead of the 6 per cent stock and would only be issued as 6 per cent stock is turned in.

President Viele frankly says that except by the adoption of such a plan "no dividends on stock can be expected for many years." Holders of the 6 per cent preferred may hold on, of course, but the exchange offers some pretty definite advantages. These may be thus enumerated: (1) The exchange gives holders an issue on which dividends may come very soon; (2) it gives holders a stock that carries a 7 per cent as against a 6 per cent rate; (3) the new 7 per cent stock outranks the old 6 per cent, and (4) an exchange helps the company to clear its financial structure in a way that almost certainly will result in greater growth for the company and better earnings.

Utilities in Arkansas Merge

The Arkansas Light & Power Company, a subsidiary of the Southern Power & Light Company, announces the acquisition from the Arkansas Utilities Company of the electric light and power distribution systems at Clarendon, Brinkley and Cotton Plant, Ark. These towns have been supplied with power by the Arkansas Light & Power Com-



TRANSMISSION SYSTEM OF SOUTHERN POWER & LIGHT COMPANY

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par value of stocks is $100.)

Companies	Bid Price Saturday, July 26	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	95	94	97½
Appalachian Power, 7 per cent	86	85½	90
Arkansas Light & Power 7 per cent	90	81	93
Asheville Power & Light 7 per cent	96	96	99
Carolina Power & Light 7 per cent	97	95½	100
Central Illinois Public Service 6 per cent	84	84	87
Central Indiana Power 7 per cent	85	80	90
Colorado Power 7 per cent	87	90	97
Connecticut Light & Power 7 per cent	99	99	102
Consumers' Powe 6 per cent	88	85	92
Dayton Power & Light 6 per cent	83	84	90
Duquesne Light 7 per cent	105	103½	107½
Eastern Texas Electric 6 per cent	93	81	95
Empire District Electric 6 per cent	73	70	78
Fort Worth Power & Light 7 per cent	97	97	100
Great Western Power 7 per cent	97	96	98
Illinois Northern Utilities 6 per cent	82	82	87
Kansas Gas & Electric 7 per cent	93	92	97
Long Island Light 7 per cent	98	95	98
Minnesota Power & Light 6 per cent	80	78	87
Mississippi River Power 6 per cent	85½	80	88½
Nebraska Power 7 per cent	95	89	99
Niagara Falls Power 7 per cent—25	*a* 28½	27	28½
Niagara, Lockport & Ont. Power 7 per cent	101	99½	104½
Northern States Power 7 per cent	93½	91	97
Ohio Public Service 7 per cent	90	86	93
Pacific Gas & Electric 6 per cent	91	85½	92½
Penn-Ohio Power & Light 7 per cent	91	84	96½
Pennsylvania Power & Light 7 per cent—no par	98½	93	99
Penn. Public Service 7 per cent	90	90	100
Southern California Edison 8 per cent	115	112	119
Tennessee Electric Power, 6 per cent	76½	71	79½
Texas Power & Light 7 per cent	95½	95	96½
‡Philadelphia Electric 8 per cent—25	*a* 35½	29	36½
Utah Power & Light 7 per cent	95½	94	96½
Western States Gas & Electric 7 per cent	78	78	85
Yadkin River Power, 7 per cent	96	94	96½
Holding Companies			
American Gas & Electric 6 per cent—50	46	41½	46
American Light & Traction	91	91	94½
American Power & Light 6 per cent	91	84	91
American Public Service 7 per cent	84	84	88
American Public Utilities 7 per cent	77	73	85
American Water Works & Electric 7 per cent	*a* 98	89½	99
Carolina Power & Light	97½	95½	99
Cities Service 6 per cent	72½	67	73½
Consolidated Gas 6 per cent—50	57	51	58
Continental Gas & Electric 7 per cent	85	69	90
Electric Bond & Share 6 per cent	100	96½	103
General Gas & Electric 8 per cent—no par	101½	96	101½
Illinois Power & Light 7 per cent	92	84	95
Middle West Utilities 6 per cent	86	80	89
National Power & Light 7 per cent—no par	90½	84	96½
North American 6 per cent—50	*a* 49½	43½	50½
Philadelphia Company 6 per cent—50	45½	42½	45½
Public Service Corp. of N. J. 7 per cent	97½	96½	100
Public Service Corp. of N. J. 8 per cent	*a*108½	99½	108½
Standard Gas & Electric 8 per cent—50	49½	46½	49½
‡United Gas Improvement—50	57	55½	58
United Light & Power 6½ per cent—no par	77½	75½	80
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	33½	22½	34
Appalachian Power—no par	76	66⅔	93
Arkansas Light & Power	45	22	47
Brooklyn Edison	*a* 115½	107½	116
Buffalo General Electric	145	118	150
Carolina Power & Light	140	82½	150
Colorado Power	33	21	35
Commonwealth Edison	126	126	135
§Consolidated Gas, Electric Light & Power	*a* 116½	113	118½
Dayton Power & Light	115	70	120
Detroit Edison	*a* 107	102½	108½
|| Edison Electric Illuminating of Boston	*a* 181½	163½	181
‡Erie Lighting	25½	23½	30
*Kentucky Hydro-Electric	87½	85½	87½
Long Island Lighting	185	100	185
Mississippi River Power	30	18½	31
Montana Power	*a* 68	61½	71
Niagara Falls Power—no par	45	45	48
Niagara, Lockport & Ontario Power—100	53	45	59
Northern Ohio Electric—no par	12	5	16
Northern States Power	99	92	106
North Texas Electric	61	58	84
Pacific Gas & Electric	*a* 94½	90½	95½
‡Penn Central Light & Power—no par	59½	57	60
Pennsylvania Water & Power	107	98½	110
‡Philadelphia Electric—25	*a* 355	29	37½
Public Service Co. of Northern Illinois	97	97	104
Puget Sound Power & Light	60	43½	61½
Southern California Edison	98	95	106
Tampa Electric	155	134	160
Tennessee Electric Power—no par	39½	20	40½
Virginia Power	49	16	60
Virginia Railway & Power	*a* 62½	36	72½
West Penn. Co.	*a* 88½	47½	98

Companies	Bid Price Saturday, July 26	Low 1924	High 1924
Holding Companies			
‡American Electric Power—50	62	22½	62½
American Gas & Electric—no par	77½	43½	78½
American Light & Traction	134	115	140½
American Power & Light	290	220	290
American Public Utilities	67	35	72
American Water Works & Electric	*a* 113	40	115½
Carolina Power & Light—no par	143	103	146
Cities Service	136½	140	155
Columbia Gas & Electric —no par	*a* 42½	33	42⅝
Commonwealth Power Corp.—no par	94½	56	98
Consolidated Gas—no par	*a* 71½	60⅞	71½
Continental Gas & Electric	58	49	62
Federal Light and Traction	*a* 77	77	84
General Gas & Electric	54	22	55
Lehigh Power Securities—no par	80	31	81⅜
Middle West Utilities—no par	56	41	60
National Power & Light—no par	132	60	140
Philadelphia Co.—50	*a* 51½	42⅞	53⅜
Power Securities—no par	10½	4	11
Public Service Corp. of N. J.—no par	*a* 56½	3[illegible]	56½
Standard Gas & Electric—no par	*a* 36½	31½	37⅜
United Gas & Electric (Conn.)—no par	35½	14	42
Utah Securities	*a* 28⅜	16⅜	31½
BONDS			
Operating Companies			
Adirondack Power & Light	6s 1950	102½	97½ 102½
Alabama Power	5s 1946	95	90½ 96
Appalachian Power	5s 1941	94½	89 94½
Brooklyn Edison	5s 1949	*a* 100⅜	97½ 102½
	6s 1930	105⅜	102½ 106
	7s 1930	107½	105½ 109
	7s 1940	*a* 109½	108 110
Central Indiana Power	6s 1947	93	88 95
Commonwealth Edison	5s 1943	99½	95 100
	5s 1953	*a* 98½	92 99½
§Consol. Gas, Elec. Lt. & Pwr.	4½s 1935	94½	91½ 95
	6s 1949	105	101⅜ 105
	6½s 1951	108	107 108⅛
Consumers' Power	5s 1936	98½	94½ 99½
Duquesne Light	6s 1949	*a* 105½	103½ 106½
Great Western Power	5s 1946	94½	90½ 96
Kansas City Power & Light	5s 1952	*a* 94	89 94
Mississippi River Power	5s 1951	96	92 96½
New England Power	5s 1951	98½	97 100
Northern States Power	5s 1941	*a* 94	89½ 94
	6s 1941	*a* 103½	96½ 103½
Pennsylvania Water & Power	5s 1940	99	96 99½
‡Philadelphia Electric	5s 1966	100⅜	97 101½
	5½s 1947	103½	99½ 103⅜
	5½s 1953	103⅞	98½ 103¾
	6s 1941	*a* 106	103⅞ 106⅜
Southern California Edison	5s 1939	98½	96 99
	6s 1944	102½	100 103½
Cleveland Electric Illuminating	5s 1939	99½	98½ 100⅜
Detroit Edison	5s 1933	101	99⅝ 101
	5s 1940	*a*101	95 101
	6s 1940	*a* 105½	104 106½
Montana Power	5s 1943	*a* 98	95 98
New York Edison	6½s 1941	*a* 112⅜	109⅞ 112⅜
Niagara Falls Power	6s 1950	*a* 105	104 105⅜
Ohio Power	7s 1951	106	103 106⅛
Texas Power & Light	5s 1937	94½	91⅜ 94½
Utah Power & Light	5s 1944	*a* 92½	87½ 93½
Holding Companies			
Alabama Traction, Light & Power	5s 1962	76½	65½ 78
American Gas & Electric	6s 2014	95½	94 95½
American Power & Light	6s 2016	94	91 94½
Amer. Water Works & Electric	5s 1934	*a* 91⅜	84½ 92
Commonwealth Power	6s 1948	*a* 94⅜	87 94⅜
Consolidated Cities Lt., Pwr. & Tr.	5s 1962	71	64 72
Illinois Power & Light	6s 1953	99½	95 100½
United Light & Railways	5s 1932	92	87½ 92
	6s 1952	96	92 96
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	97	90	97
*National Carbon	122½	115	125
†Wagner Electric	81½	77	84
COMMON STOCKS			
Allis-Chalmers Manufacturing	*a* 56½	41⅜	58½
American Bosch Magneto—no par	*a* 29	22½	38½
Electric Storage Battery—no par	*a* 58	50½	64
General Electric	*a*257½	193½	258½
General Electric—10	*a* 11½	10⅜	11½
*Hurley Machine—no par	*a* 59½	48	59½
Manhattan Electric Supply—no par	*a* 47½	30½	51½
*Vesta Battery—no par	18	15½	28
†Wagner Electric	25	24	34½
Westinghouse Electric & Manufacturing—50	*a* 64⅞	55½	65
Worthington Pump & Machinery	*a* 27½	23½	31½
BONDS			
Canada General Electric	6s 1942	105½	102⅝ 105½
General Electric	3½s 1942	83	80 83
	5s 1952	*a* 103½	100 103½
Robbins & Myers	7s 1952	79¾	75½ 91½
†Wagner Electric Manufacturing	7s	100	97 100
Western Electric	5s 1944	*a* 98½	96 98⅝
Westinghouse Electric & Mfg.	7s 1931	*a* 108½	106⅜ 109½

* Chicago Stock Exchange. † St. Louis Stock Exchange. ‡ Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Wednesday, July 30.

pany through transmission lines from Pine Bluff under a wholesaling agreement for a number of years. The Arkansas Light & Power Company has also acquired from the Arkansas Utilities Company its plants at Rison, Kingsland and Fordyce, Ark., and purposes to proceed immediately with the construction of a 66,000-volt transmission line between Pine Bluff and Camden which will supply these three communities. This transmission line will also supply additional power for the needs of the oil fields in the El Dorado and Camden district. In exchange for these properties the Arkansas Light & Power Company has sold its plant at Paragould, in the northeastern corner of the state.

North American Light & Power Company.—The North American Light & Power Company called for payment on August 1 at par and interest all of the outstanding $1,450,000 serial secured 7 per cent gold notes due April 1, 1926.

New Jersey Merger Approved in May Now Effective.—The Public Service Corporation of New Jersey, in accordance with permission accorded last May by the Board of Public Utility Commissioners, filed with the Secretary of State of New Jersey on July 25 a merger certificate whereby the Public Service Electric Company, the Public Service Gas Company and the United Electric Company of New Jersey will be combined into one unit under the name of the Public Service Electric & Gas Company. The capital stock of the new organization will be 20,000,000 shares of common stock with no par value and 300,000 shares of preferred stock, each with a par value of $100. The details of the plan for readjustment were summarized in the March 22 issue of the ELECTRICAL WORLD. One of the first steps taken to complete the merger of the three companies was the issuance of $20,000,000 Public Service Corporation of New Jersey secured gold bonds, proceeds of which will be used to retire higher interest-bearing issues now outstanding. The officers of the new corporation are: Thomas N. McCarter, president; Percy S. Young, Edmond W. Wakelee, Dudley Farrand, John L. O'Toole, Henry D. Whitcomb and Farley Osgood, vice-presidents; Charles M. Breeder, secretary, and T. W. Van Middlesworth, treasurer.

One Hundred Millions Raised in July

Electric Light and Power Companies of the Country Dispose of Four Times as Many Securities as They Did in July, 1923

DURING the month of July investment houses offered new issues of electric light and power stocks, bonds and notes to the amount of $93,753,500, exclusive of the $17,000,000 issue of the Great Consolidated Electric Power Company, Ltd., of Japan, details of which appeared in the last two numbers of the ELECTRICAL WORLD. The monthly total, though representing a decrease of more than $17,000,000 under that reached in June, when the record for the current year was broken, is approximately four times as great as the total of July, 1923. The financing was essentially of a long-term nature, only three issues being for less than a ten-year period. The average yield advanced to 6.53 per cent from 6.09 per cent for the previous month. The largest single offering was the $20,000,000 issue of secured gold bonds of the Public Service Corporation of New Jersey, primarily a refunding proposition. A prominent part was taken by preferred stock in the month's activities.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JULY

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Georgia Railway & Power Co.	$2,500,000	..	Cumulative first preferred stock, series of 1924	Additions and improvements	7	95	7.37
North American Light & Power Corp. (Ill.)	6,300,000	30	Sinking-fund secured gold notes	Refunding and for working capital	7	100	7
Holtwood Power Co. (Pa.)	2,750,000	30	First mortgage sinking-fund gold bonds, series A	Construction	6	99	6.07
Luzerne County Gas & Electric Co. (Pa.)	3,000,000	20	Sinking-fund convertible gold bonds	Refunding	7	99	7.09
	6,000,000	30	First and refunding mortgage gold bonds	Construction	6	98*	6.15
Northern Indiana Gas & Electric Co.	4,500,000	3	Secured gold notes, series A	Additions and to reimburse for capital expenditures	5½	99½	5.75
Ottawa-Montreal Power Co., Ltd.†	1,250,000	25	First mortgage sinking-fund gold bonds	To finance merger resulting in present company	6½	100	6.50
Sierra Pacific Electric Co. (Nev.)	700,000	1	Gold coupon notes	To take up bank loans	5	100	5
Carolina Power & Light Co.	796,000	..	Cumulative preferred stock	Additions and other corporate purposes	7	99½	7.04
Central Illinois Public Service Co.	6,000,000	20	First mortgage and refunding gold bonds, series C	Refunding, to reimburse for expenditures and for other corporate purposes	6	97	6.25
Illinois Power & Light Corp.	5,000,000	..	Cumulative preferred stock		7	95	7.37
Portland Electric Power Co. (Ore.)	1,000,000	..	Cumulative prior preferred stock	To reimburse for construction expenditures	7	98½	7.10
Kewanee Public Service Co. (Ill.)	1,200,000	25	First mortgage gold bonds, series A	To acquire additional properties	6	95	6.40
Laurentian Hydro-Electric, Ltd., (Que.)	500,000	10	First and refunding mortgage sinking-fund gold bonds, series A	Construction	6½	97.15	6.90
Los Angeles Gas & Electric Corp.	5,000,000	..	Cumulative preferred stock	Additions	6	90	6.67
Matapedia Valley Light & Power Co., Ltd. (Que.)	350,000	20	First mortgage full sinking-fund gold bonds	Construction	6½	99	6.60
Virginia Northern Power Co.	375,000	20	First mortgage gold bonds, series A	To finance merger	6½	96	6.87
Illinois Power Co.	750,000	20	First mortgage gold bonds, series C	Additions	6	97	6.25
Houston Lighting & Power Co. (Tex.)	1,000,000	29	First lien and refunding mortgage gold bonds, series A	Additions and other corporate purposes	5	91½	5.60
Pennsylvania Water & Power Co.	1,000,000	29	First refunding mortgage gold bonds, series A	Construction and other corporate purposes	5½	99	5.55
Associated Gas & Electric Co. (N. Y.)	3,500,000	30	Secured gold bonds convertible	Refunding and other corporate purposes	6½	94½	6.94
Central Power & Light Co. (Mo.)	1,250,000	..	Cumulative preferred stock	To acquire prior debt, to furnish additional working capital and for general corporate purposes	7	92½	7.57
Community Power & Light Co.	782,000	9	First mortgage collateral sinking-fund gold bonds, series C	To finance acquisition of new properties in part	6½	99	6.25
Idaho Power Co.	3,000,000	23	First mortgage gold bonds	Refunding	5	93½	5.30
Utica Gas & Electric Co. (N. Y.)	2,000,000	..	Cumulative preferred stock	To pay off notes falling due and for construction purposes	7	102	6.85
Western United Gas & Electric Co. (Ill.)	1,854,000	26	General mortgage gold bonds	Refunding and to reimburse company for extension expenditures	6	100	6
	946,000	..	Bonds		5	88	5.90
	200,000	..	Bonds ‡		5	100	5
Cumberland County Power & Light Co (Me.)	478,000	18	First and refunding mortgage gold bonds		5	93½	5.60
Tennessee Electric Power Co.	1,000,000	..	Cumulative first preferred stock	To reimburse for additional property expenditures	7	94	7.40
Wisconsin Power & Light Co.	2,250,000	20	First lien and refunding mortgage gold bonds, series C		6	96½	6.30
Virginia Power Co.	3,022,500	..	Prior preference stock, series A	Addition	7	93	7.50
Ohio Electric Power Co.	750,000	20	First mortgage gold bonds, series A, sinking fund	To finance merger	6½	99½	6.50
Public Service Corp. of New Jersey	20,000,000	20	Secured gold bonds	Refunding and for other corporate purposes	6	96	6.35
Atlantic City Electric Co.	2,750,000	30	First and refunding mortgage gold bonds	To reimburse company for expenditures or additions	5½	98½	5.60
Total	$93,753,500						

* Less discount. † Carries bonus of two and one-half shares of common stock of no par value with each $1,000 bond. ‡ Carrying 1 per cent unsecured additional coupons.

Binghamton Company to Be Retained.—The General Gas & Electric Corporation will retain the Binghamton Light, Heat & Power Company, according to an announcement made by W. S. Barstow & Company. Negotiations which have been pending for its sale to the American Gas & Electric Company have been terminated. The Barstow company plans to expand the Binghamton utility, the owners of which have just acquired the Susquehanna County Light & Power Company at Susquehanna, Pa., heretofore in the control of the Keystone Utilities Company and operated by the United Service Corporation.

Parent Company Calls Meeting to Ratify Stock Sale of Subsidiary.—The overtures made by H. M. Byllesby & Company to obtain control of the Sierra & San Francisco Power Company, a subsidiary of the California Railway & Power Company, which were outlined in the July 12 issue of the ELECTRICAL WORLD, have resulted in the California company's calling a meeting of its stockholders to ratify the proposal for sale of all the capital stock of the subsidiary property. The terms of the proposed sale provide that the California Railway & Power Company will receive $650,000 cash, $500,000 par series B Sierra & San Francisco bonds, $950,000 promissory notes of Byllesby & Company, payable in one year with interest at 5 per cent, secured by Sierra & San Francisco capital stock, and $2,500,000 promissory notes of Byllesby & Company, payable January 1, 1935, without interest, also secured by the capital stock of the Sierra & San Francisco Power Company.

Briefer News

Georgia Legislative Committee Does Not Favor Public Ownership. — The House committee on constitutional amendments of the Georgia Legislature has voted unanimously to report unfavorably two measures designed to allow counties and municipalities to issue bonds for water-power development. The bills were sponsored by the Municipal League of Georgia. P. S. Arkwright, president of the Georgia Railway & Power Company, and other representatives of the power interests of the state opposed them.

To Complete 250-Mile High-Tension Line from Gentry, Mo., to Kearney, Neb.—Sixty miles of 66,000-volt transmission line which will tie in the Nebraska South Platte properties of the Continental Gas & Electric Corporation with the company's properties in Iowa and northern Missouri will be built this summer and fall by the Nebraska Gas & Electric Company, a subsidiary of the Continental. The line, which will be the first of such high voltage in the state, will connect Lincoln and Plattsmouth, Neb., and will be the final link in a continuous circuit extending from Gentry, Mo., to Kearney, Neb., a distance of 250 miles straight across country. Two hundred miles of the distance will be on Continental lines and 50 miles will be on lines of the Central Power Company, an Insull utility. Completion of the line will make available for the Iowa and northern Missouri properties the generating facilities of eight steam plants and of six hydro-electric plants in Nebraska.

Northern States Company's New Power Station Put in Operation.—The new High Bridge power station of the Northern States Power Company at St. Paul, Minn., has gone into operation following the completion of the first 40,000-hp. steam turbine unit. Work on the second 40,000-hp. unit is well advanced. The plant is exceeded in size only by one other in the Central Northwest, the Riverside station of the Northern States Power Company in Minneapolis.

Sea Isle City Turns to Central-Station Service.—With the cost of producing electrical energy in an antiquated municipal electric plant placed at 10 cents per kilowatt-hour, the City Commission of Sea Isle City, N. J., has decided to junk the plant and buy its electricity from the Atlantic City Electric Company, which has offered to supply it at 5 cents per kilowatt-hour. The Atlantic City company will construct its lines up to the Sea Isle City limits, laying a cable across Ludlam's Thoroughfare, which separates Sea Isle from the mainland.

Municipal and Central-Station Operation in Indiana.—The Town Board of Rockville, Ind., has made a tentative contract with the Wabash Valley Electric Company of Clinton, Ind., to purchase energy for a period of ten years. Accountants for the city have agreed that the company can provide energy at less cost than the municipal plant and will give better service. The City Council of Delphi, Ind., on the other hand, wants to acquire the electric distributing plant there, now owned and operated by the Indiana Service Corporation, and the city attorney has been authorized to prepare preliminary plans.

Hydro-Electric Plant for Gasconade River.—Ten million dollars is named as the ultimate cost of the water-power project on the Gasconade River in Missouri for which the Central Missouri Power & Water Company holds a preliminary permit from the Federal Power Commission. A lake 50 miles long and from half a mile to a mile in width will be formed by the erection of a 95-ft. dam. The continuous horsepower available is estimated at about 30,000 hp., and plans have been made for the installation of six or seven 5,000-kw. generators. Installation of a park section around the reservoir is talked of, the site being said to be adapted for a summer resort.

Pacific Gas & Electric Raising Dam. —Work on the raising of the Lake Fordyce dam of the Pacific Gas & Electric Company, which is on Fordyce Creek, a tributary of the South Fork of the Yuba River, about 9 miles from Cisco, Cal., has been resumed. The dam will be raised 47 ft. and the capacity of the reservoir thus created will nearly double that of the dam originally built there in 1881. The storage capacity of Lake Fordyce will be 47,000 acre-feet when the present construction work is completed. The dam is a rock-filled structure about 800 ft. long, 140 ft. thick at the foundation, and when completed in 1881 rose to a height of 92 ft. It is hoped to complete the elevation this year.

Indian Guides Called Upon to Help Restore Service.—Troublemen employed by the Iowa Railway & Light Company, in an effort to restore service to a number of towns in Tama and adjoining counties after a recent big flood, had to secure the services of an Indian guide from the Tama reservation, who with ponies and dogs piloted the men across the Ravin Creek bottom to the substation at Montour, and another guide to pilot their crossing of the river bottom north of Montour in order to reach and open lines between Montour and Reinbeck. The operator at Blairstown stood in six inches of water in the substation to handle the oil switches. A large force of men worked night and day to restore the crippled service of twenty-five towns.

Ford Company Starts Plant at High Dam, Twin Cities.—Energy wasted at the High Dam in the Mississippi River at Minneapolis and St. Paul for more than a decade came in use recently, when the Ford Motor Company began actual production of electricity at its partly complete hydro-electric station. The Ford company is utilizing the power under contract with the government. A fifty-year lease provides that all power must be used, and the Northern States Power Company has contracted to use any surplus. Lines already are connected with the hydro-electric station, and as soon as tests at the station are completed and the switchboard is finished electricity from the High Dam will be supplied to Twin City's industries. The plant is to be completed within a month. Four waterwheels and four generators will develop 18,000 hp. as the maximum output of the station.

California Irrigation Districts and Power Generation. — Headed by the Fresno district, a group of irrigation districts on Kings River, California, is making every effort to put through the proposed Pines Flat reservoir. This reservoir will be of much importance to the San Joaquin Light & Power Company, since it will permit that company to store for power without regard for the irrigation rights in the valley below. The irrigation interests also are proposing to construct a large storage basin on the San Joaquin in the Kerckhoff region. The Merced Irrigation District hopes to put through promptly its project at the Exchequer dam site for which a license recently was issued by the Federal Power Commission, and construction work is to begin as soon as the bonds are sold. The Oakdale Irrigation District is investigating a reservoir site in the Stockton region which involves a power development. The Modesto Irrigation District, not

satisfied with the offer made it by the Pacific Gas & Electric Company, has undertaken to retail its own power. The experiment in retailing is likely to be watched closely by other irrigation districts in California which have surplus power.

Municipal Project at Aberdeen, Wash., Strikes Another Snag.—The City Council of Aberdeen, Wash., has appealed to the State Supreme Court from a decision of the Superior Court of Thurston County which invalidated bonds of the city of Aberdeen voted for the purpose of acquiring water resources on the Wynooche River to enable the city to increase its output of electric power and provide for a water supply. The lower court held the election invalid and granted an injunction restraining the city from completing the project on the ground that it was a combination of two dissimilar projects. The water-power project was first halted when a temporary restraining order was issued early this year prohibiting the city from attempting to secure water rights on the Wynooche authorized by the voters last December as a step in the erection and development of a power plant. The voters authorized a two-million-dollar bond issue.

Central Maine Purchases Shawmut Plant.—The Central Maine Power Company has purchased the capital stock of the Shawmut Manufacturing Company, Shawmut, Me., and will thereby add to its resources a modern concrete power plant containing 6,000 hp. of hydro-electric machinery, together with the so-called Shawmut dam on the Kennebec River at that place. This plant was built about eleven years ago and since then the Central Maine company has purchased 2,000 hp. annually from the Shawmut company. With a moderate outlay the capacity of the installation can be increased to 10,000 hp. The present head is 21 ft., and the acquisition of this property gives the Central Maine company complete control of the water on the Kennebec from its Skowhegan development to the outskirts of Waterville. This control will enable the plants to be handled at better efficiency. The Shawmut dam is the longest on the Kennebec River, which is 1,140 ft. wide at this point.

Two South Jersey Companies to Connect Lines.—By the construction of a 66,000-volt transmission line from Atlantic City to Pennsgrove, N. J., with a tap at Williamstown, about halfway between the two cities, the Atlantic City Electric Company and the Electric Company of New Jersey will connect their south Jersey, Delaware and eastern Pennsylvania lines. The Electric Company of New Jersey, with its main plant at Wilmington, Del., serves all the western part of south New Jersey, including Cumberland, Salem and Gloucester Counties, while the Atlantic City company controls the eastern part of the section, including Atlantic and Cape May Counties. With this connection of the lines only two communities south of Camden County will be independent of the combination—Vineland, which has a municipally owned plant, and Millville, which is controlled by the R. D. Wood interests of Philadelphia. As the peak load of the western part of the state comes during the day because of the many industries using electric power, the Atlantic City company will place from 10,000 kw. to 15,000 kw. at the disposal of the Electric Company of New Jersey in daytime and take in return from 3,000 kw. to 4,000 kw. at night to help out the lighting systems of the seashore resorts to which it gives service.

Plans of Northern New York Utilities, Inc.—Two points are now before the New York Public Service Commission for decision in connection with the recent approved purchase of the Rome Gas, Electric Light & Power Company by the Northern New York Utilities, Inc., of Watertown. The first is whether the city of Rome, which granted the franchise to the local company, must approve its transfer. The second is whether the consent of towns to be crossed by the proposed transmission line from Boonville to Rome must be obtained. It is not proposed by the Northern New York Utilities to serve these towns but merely to construct its lines through them. The company has also petitioned for leave to construct a transmission line on a right-of-way from Black River, Jefferson County, to Altmar, Oswego County, to unite its lines with those of the Niagara, Lockport & Ontario Power Company. The Niagara company will supply the Northern Utilities with night power for industrial purposes in exchange for daytime power from the Northern Utilities.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

Conference of Electrical Leagues, Association Island, Henderson Harbor, N. Y., Sept. 2-6. Address Society for Electrical Development, 522 Fifth Avenue, New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 3-6. H. M. Stine, 212 Locust St., Harrisburg.

Association of Edison Illuminating Companies—Griswold Hotel, New London, Conn., Sept. 8-12. P. S. Millar, 80th St. and East End Ave., New York.

Michigan Electric Light Association—Hotel Statler, Detroit, Sept. 9-11. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

New England Division, N. E. L. A.—Hotel Wentworth, Portsmouth, N. H., Sept. 10-13. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. O. A. Weller, 900 15th St., Denver.

Colorado Public Service Association—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. J. F. Greenawalt, Mountain States Telephone & Telegraph Company, Denver.

Southeastern Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Sept. 15-20. J. F. Kelly, 513 Empire Building, Pittsburgh.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 24-27. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden Springs, Ind., Sept. 29-Oct. 4. L. W. Davis, 15 W. 37th St., New York.

American Electrochemical Society—Hotel Fuller, Detroit, Oct. 2-4. Colin G. Fink, Columbia University, New York.

Oklahoma University Will Probably Start Public Utility Course.—It is announced that courses of study to fit young men and women for positions in the public utility business will in all probability be started at the University of Oklahoma next fall. President Buchanan and the deans of the schools teaching branches that would be embraced in a general utility course are working the matter out.

Another Ohio "Tie-in."—The transmission systems of the Pennsylvania-Ohio Power & Light Company and the Ohio Public Service Company have been tied in at Evergreen substation, south of Warren, Ohio, following the completion of the Pennsylvania-Ohio company's power transmission line between its Brier Hill substation at Youngstown and the Evergreen station on the Alliance-Warren line of the Ohio Public Service Company. The distance bridged by this final link is 10 miles. This connection will give the Pennsylvania-Ohio power users direct service, when necessary, not only from the Ohio Public Service, but also from the Ohio Power Company, the Northern Ohio Traction & Light Company and the Cleveland Illuminating Company. The Pennsylvania-Ohio transmission system will be carried from the Brier Hill substation to a new substation now under construction at Boardman, south of Youngstown, joining there a transmission line from the new superpower plant which is being erected for the Pennsylvania-Ohio Power & Light Company at Toronto, Ohio, on the banks of the Ohio River.

Merged Canadian Power Companies Elect New Officers.—At a meeting of the board of directors of the Canadian Light & Power Company, one of the organizations concerned in the merger of Montreal power companies referred to in the ELECTRICAL WORLD for June 21, page 1298, the resignations of E. A. Robert, J. F. Shaw, George G. Foster, J. M. McIntyre, K. B. Thornton and Senator N. Curry were accepted. The following were elected to fill the vacancies: Julian C. Smith, Howard Murray, Gordon W. MacDougall, George Montgomery, John S. Norris and C. S. Bagg. Julian C. Smith was elected president and John S. Norris vice-president. At a meeting of the board of directors of the Quebec-New England Hydro-Electric Corporation the resignations of J. M. Wilson, William C. Finley, K. B. Thornton, F. J. Shaw and P. J. McIntosh were accepted, and John S. Norris, C. S. Bagg, G. R. Whatley, George Montgomery and Julian C. Smith were elected in their stead. The remaining members of the old board, including E. A. Robert, J. M. McIntyre, J. L. Perron and Senator N. Curry, then resigned. John S. Norris was elected president and C. S. Bagg vice-president.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in All Branches of the Electrical Industry

J. D. Whittemore General Manager at Fairmont

J. D. Whittemore, who has been general manager of the public utilities operated under the Barstow management at Greensboro, N. C., has been appointed general manager of the Monongahela-West Penn Company, Fairmont, W. Va., according to an announcement by Captain George M. Alexander, president of the organization. Mr. Whittemore will be general manager of the light, railway and gas branches. At one time Mr. Whittemore was associated with the General Electric Company at Schenectady, later being transferred to Boston to the construction department. Subsequently he entered the industrial engineering department of the Rochester Railway & Light Company and in the fall of 1917 was appointed general manager of the West Virginia Traction & Electric Company in Wheeling, following a general managership with the Claremont (N. H.) Railway & Lighting Company. Before joining the Barstow Management Corporation Mr. Whittemore was identified with West Penn interests in Pittsburgh.

J. A. McKeon, formerly secretary to T. E. Murray, vice-president of the New York Edison Company, has been appointed assistant secretary of the company to succeed F. W. Jesser.

J. H. Stribling, who has been superintendent of distribution and installation in Richmond for the Virginia Railway & Power Company, has been made superintendent of light and power for the Richmond-Petersburg division of the company. This is a new office.

E. J. Rosenauer, formerly general auditor of the Southern Colorado Power Company of Pueblo, Col., and more recently connected with the Wisconsin-Minnesota Power Company, has been transferred to the Pacific Coast with headquarters in Stockton, Cal., where he will be general auditor of the H. M. Byllesby properties on the Coast.

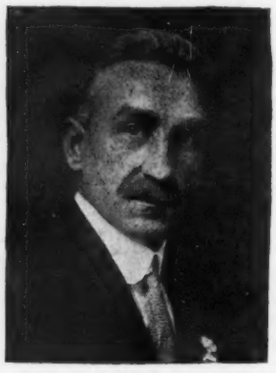
Val A. Fynn, consulting engineer of St. Louis, and known also for his prowess as a mountaineer has succeeded in scaling Mount Geikie, the highest peak in the Rampart Range, Jasper National Park, Alberta, Canada. He and two Canadians were the first "Alpinists" in Canada and the United States actually to reach the summit of this mountain.

Eugene Messinger has severed his connection with the Adirondack Power & Light Corporation, Schenectady, N. Y., and is now electrical designer in the engineering department of the Otis Elevator Company, New York.

Prof. Vladimir Karapetoff of the school of electrical engineering at Cornell University was nominated on the Socialists' New York State ticket for the office of State Engineer and Surveyor at the recent convention held in New York City. Two years ago the late Dr. Steinmetz was the Socialist party's nominee for the same office.

F. W. Jesser Appointed Secretary of New York Edison

F. W. Jesser, assistant secretary of the New York Edison Company for the past four years, has been appointed secretary of the company by the executive committee to succeed the late Walter Neumuller. Mr. Jesser, who has also been serving as secretary to vice-president John W. Lieb, brings to his new post a wide and varied experience obtained through thirty-five years' close association with the electrical industry. Starting as a clerk with the Mount Morris Electric Light Company, after completing his high-school course and private studies, he advanced rapidly in the ranks of the company, and when the organization was amalgamated with the Edison Illuminating Company in 1898 he was promoted to the managership of the correspondence department. In 1900, after the formation of the New York Edison Company, Mr. Jesser was transferred to the office of Mr. Lieb, in whose department he has spent twenty-six years. Four years ago he was appointed assistant secretary.



F. W. JESSER

Mr. Jesser has taken an active part in the affairs of the National Electric Light Association, the Illuminating Engineering Society and the New York Electrical League. He has also shown marked interest in the practice of the Electrical Testing Laboratories, of which he is assistant treasurer, and has accomplished a great volume of meritorious work for the Association of Edison Illuminating Companies.

R. J. Throckmorton, formerly electrical engineer with the Virginia Railway & Power Company, Richmond, has been appointed superintendent of the light and power department for the Norfolk-Portsmouth division of the company. This position has recently been created.

W. A. Bartlett, managing director of Brandes Limited, England, who came to this country to attend the annual conference of the executives of the Brandes Companies, has left for home. He is accompanied by **L. W. Staunton**, advertising manager of C. Brandes, Inc., who has gone abroad to consult with the advertising agency of the English company with a view to coordinating the Brandes international advertising.

Obituary

Guy L. Brokaw of Plymouth, Ohio, chief engineer and superintendent for the Board of Public Affairs at the local municipal power plant, was killed on July 22 at the station when he came in contact with a 13,000-volt transmission line. Mr. Brokaw was fifty years of age.

William Lowell Putnam of Boston, a director of the American Telephone & Telegraph Company and also of a number of public utilities under the management of Stone & Webster, Inc., died suddenly on July 27 at Cotuit, Mass. Mr. Putnam was born in 1862 and was a graduate of the Harvard Law School, class of 1886. The varied interests he represented as counsel led to his becoming a member of the board of many important corporations in the New England States.

John H. Dunlap, secretary of the American Society of Civil Engineers, died July 29 at the Presbyterian Hospital, Chicago, as a result of injuries sustained in a railroad accident a month ago, when he was returning East from the meeting of the Society for the Promotion of Engineering Education at Boulder, Col.. He became secretary of the society two years ago, when he left the position of professor of hydraulics and sanitary engineering at the State University of Iowa, Iowa City. Mr. Dunlap was a native of Harrisville, N. H., and was forty-two years of age.

Charles F. MacGill, formerly works manager of the Canadian General Electric Company at Peterboro, Ontario, died at Boston, July 27, at the age of sixty. He was a native of Keeseville, N. Y., and his earlier years were spent in the copper-mining industry of Michigan. Later he was connected with the Westinghouse Agricultural Works at Schenectady and for twelve years was employed at the Schenectady and Pittsfield factories of the General Electric Company. He was works manager at Peterboro for five years and later was manager of the Carrier Laine Company, Quebec, and of the St. Louis plant of the Diesel Engine Company. During the world war he was engineer of the bayonet department of the Remington Arms Company, Bridgeport, Conn., and works manager of the Bullard Machine Company at the same city.

Commission Rulings

Dividends and Depreciation.—An application for increased electric rates was granted by the Wisconsin Railroad Commission to the Porter Electric Line, subject to an understanding that in the future no dividends should be paid unless they had actually been earned, and, further, that each year during the next five years the company should set aside at least 50 per cent of its depreciation reserve provision in a fund which could readily be converted into cash. These restrictions were made because of the past practice of declaring an 8 per cent dividend whether earned or not. This practice, the commission condemned, declaring that it had resulted in producing deficits in annual operating statements and in depleting the assets of the company.

Minimum Charge Should Be Uniform to All Unless Undue Burden Is Involved. — In reducing a minimum charge made by the Milo (Me.) Electric Light Company to residents of Sebec because it was higher than the minimum charge made to residents of Milo, the Maine Public Utilities Commission asserted that an electric utility should not make a minimum charge larger for part of its patrons than for other patrons because service to them is less profitable unless an undue burden would otherwise be placed upon the company and its other consumers. "Although it appears that the expense to the company of serving some of its customers is greater than the cost of service rendered to other of its customers who are located in Milo village and also in Sebec village," the commission said, "we believe that the situation on the whole system is such that all of the customers whom the company is attempting to serve ought to receive their service on the same rate basis." The commission declared the existing rates discriminatory.

Rules Governing Rural Service in Missouri. — In passing upon rules adopted by the West Missouri Power Company to govern its farm service, the Missouri Public Service Commission declared the following regulations reasonable and duly approved them: A rule providing that the utility would furnish and maintain all meters; a rule providing that all customers should send in readings of meters on a card furnished by the utility regularly each month and that any customer failing for thirty days to make payment should be discontinued, provided that forty-eight hours' notice in writing were given; a provision that no discount should be allowed for prompt payment of bills; a rule that customers should be responsible for damage done to meters installed on their premises if such damage were the result of negligence or carelessness. The commission disapproved as unreasonable a rule providing that a service charge of $300 would be made for connecting up a farm customer if he were within one-third of a mile from any existing line, except in certain tracts that this charge should carry with it the maintenance of the line without extra charge for a period of ten years, that this charge should be for a capacity of 1 kw.-hr., and that on any line of more than 6,600 volts the company should not be required to put in a substation for service unless at least ten contracts were obtained and unless these would not require the building of more than 3½ miles of line from said substation. The commission decreed that the question of service charge be left in abeyance until public necessity should require a rule to be promulgated.

Extension of Service to Outlying Tracts.—A decision of the New Jersey Board of Public Utility Commissioners in the case of the Merchantville Water Power Company having an application to electric utilities as well was to the effect that rules under which those engaged in the development of real estate, but who are not interested in permanently residing in the dwellings being built, are required to pay the full cost of the extension of water mains, with a provision for reimbursement when water is used in sufficient quantities, should not be departed from in a case where a tract is so laid out by the promoters that the maximum number of customers which may be served from the mains is too small to bring to the company the amount of revenue required to support the necessary investment and the promoters can never expect to have returned to them the entire amount advanced.

Recent Court Decisions

Contract Rates Binding Until State Intervenes.—The Supreme Court of New Mexico has affirmed a judgment for the plaintiff in a suit brought by the town of Gallup against the Gallup Electric Light & Power Company to enforce a contract fixing maximum meter rates. The court held that a franchise contract providing a general rate for electrical energy fixes the rate for all purposes, including power. Where maximum rates are fixed they cannot, the court said, be increased by the public service company by any device or subterfuge such as a "ready-to-serve" or "minimum" charge. Cities and towns have power to contract with public service companies for rates to their inhabitants for electrical energy for power purposes, and these contracts are valid and binding upon the parties until the state intervenes and exercises its regulatory power. A contract between a municipality and a public utility company, the court further found, is not invalid because a portion of the service contracted for is outside the jurisdiction of the municipality. A municipality may, moreover, maintain an action for an injunction against a public utility company to restrain it from exceeding the contract rates for electrical energy, and the fact that the rate has become non-compensatory is no defense to the enforcement of the contract. (225 Pac. 724.)*

When Contract Rates Control, Although Confiscatory.—Declaring that a state may authorize a municipal corporation to establish by an inviolable contract rates to be charged by a public service corporation for a definite term, not grossly unreasonable in time, and that such contract suspends during its life the governmental power of fixing and regulating rates, the Supreme Court of the United States found, in St. Cloud Public Service Company vs. City of St. Cloud, that the public service corporation and the municipality having agreed upon rates to govern during a particular time and the municipality having the requisite authority to do this, the enforcement of rates fixed is controlled by the contract and the question whether they are confiscatory is immaterial. This decision confirms that of the United States District Court in Minnesota refusing to upset a thirty-year fuel-gas contract. (44 S. C. R. 492.)

Right to Flood Land Adjacent to Dam Site. — Superseding a previous opinion in Seymour Water Company vs. Lebline, the Supreme Court of Indiana has reversed a verdict for the plaintiff, who received damages because of the overflowing of his farm land as the result of the construction of a dam in the White River. In its judgment the Supreme Court said, among other things, that where an easement was created by express written contract lapse of time and occupation by its owner would not extinguish it unless there was an absolute denial of the right and the occupation was so adverse and hostile that owner could have maintained action for obstructing enjoyment; that intention to abandon and put an end to easement is a necessary element of abandonment; that where defendants did not exercise their right for many years, plaintiff's farming his land and raising crops thereon was not such adverse possession as would set limitations running against the right of flowage; that adverse possession, to ripen into title, must be such as would have exposed possessor to action because of what was done by him at any and all times during his twenty years' possession; that if the owners of the mill site through whom defendants derived title acquired the right to maintain a dam in connection therewith such right passed with conveyance of the mill site as an appurtenance without special mention in deed; that where defendant claimed right to dam as appurtenant to its ownership of mill site, an instruction which singled out the intermediate conveyance of the mill site in which the dam was not mentioned, saying that it conveyed no greater interest than grantor had, was misleading as a disparagement of such document, and that legislative acts declaring the branch of the White River concerned to be a public highway did not make it such a navigable stream at the dam site involved as that title to the river bed never vested in landowners on either side. (144 N. E. 30.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

A Romance in Lamp Making

How the Development of New Machinery and Factory Processes Has Wrought a Revolution in the Lamp Industry

A FEW years ago the Edison Lamp Works of the General Electric Company was operating eight factories to capacity with 900,000 sq.ft. of floor space in use, 4,000 operators at work and an output of 75,000,000 lamps a year. Today five factories are operating, with 600,000 sq.ft. in use and 2,000 employees occupied, and the output has been increased to 80,000,000 lamps a year. This has been done almost entirely by the development of new factory processes and the improvement of machinery, and it has made possible five successive reductions aggregating 37 per cent in the price of Mazda lamps to the public. It is probably the most spectacular achievement in reducing the cost of a commodity by increasing production efficiency that has ever been recorded in the electrical industry.

Incandescent lamps have been made since 1878, when Thomas A. Edison began to produce them by hand, and their manufacture continued to be largely a matter of hand production for more than twenty years. The first serious effort to develop machinery for lamp making took place between the years 1900 and 1906, when sealing-in and stem tubulating machines were perfected and put into general use, but even after that methods of machine production did not change very materially for another ten to fifteen years, for the handling of fragile glass bulbs and tubes and delicate filaments requires the utmost dexterity and care and it seemed to be by its very nature hand work.

How Lamps Are Made

The process of making a lamp consists of a succession of steps each of which is an independent operation. A bulb is made by a great machine that blows the glass automatically. A filament is made and drawn to size. A glass tube is made into a stem, a glass rod welded to it and little wire supports set into it to hold the filament. The filament is draped on and pinched fast to "leading in" wires that connect the lamp base. The lamp bulb is washed and dried. The stem within its filament is inserted into the bulb and they are fused together. The air is exhausted from the bulb and gas is inserted if it is to be a gas-filled lamp. The base is cemented on. The trade mark, wattage and voltage are etched on the bulb. The "leading-in" wires are soldered to the base. The lamp is tested. It is then wrapped and packed in a carton and then in a case. It is one long succession of little delicate operations.

Balancing Production

One of the most difficult features of lamp making from a production standpoint has always been the problem of maintaining a balance in the quantity of the different parts manufactured to prevent excess production of any one part. This has led to the necessity for storage of parts between operations. It has required a great deal of floor space and a tremendous expenditure of labor in handling and rehandling materials. Also, because certain of these successive operations would be at times more rapid than others, it was a hard matter to regulate production in the various processes to prevent over or under supply of any part. Various individual machines used in the different operations ran at their own speed of best efficiency and the effort was to keep a balance through the number of machines or operators in each department that would maintain a uniform production.

Soon after the close of the war, when industrial men began to turn their thoughts once more to plant improvements, W. R. Burrows, works manager of the Harrison, N. J., lamp factory, began to see the possibilities for correlating the machine steps in the manufacture of a lamp. His first move was to take one of the various machines out of each department and set these up side by side to work in sequence with each other and with the different hand operations required. Here he timed them and studied them. There gradually developed the conception of balancing these machines so that a rapid machine might be slowed down perhaps by a reduction in its size or speed and brought into step with the rest. A slow machine was to be speeded up. The various processes of hand work and machine feeding were to be organized into harmony with the scheme, to the end that the full succession of operations and processes might be brought into synchronized production. The result of this would be that materials would flow evenly into the unit of machines and all storage of parts between machines might be eliminated.

By a gradual evolution, the result of endless experiment and a tremendous amount of machine development entailing a very large amount of work and expense, this very end was accomplished. Gradually these individual machines were tuned and trained into a continuous co-ordination, a smooth working sequence that kept in perfect step. Then these machines began to be joined together and out of this has finally come a unit lamp-making machine, one single combined mechanism, into which glass bulbs, tubes and rods, wire and bases and packing materials are fed, and out of which come finished lamps, marked, tested, wrapped, packed and laid in a case upon a conveyor belt that carries them away to be shipped.

Saving in Labor

Whereas in the past the parts that are combined in the lamps were made in as many departments by many different machines and many workers, today there sit beside these unit lamp machines five girls, working as an organized crew. Later machines have further refined the process so that four girls are sufficient, and efforts are being made toward a still further perfection of this unit machine so that three girls will suffice. The machine will continue to turn out from 2,000 to 3,000 lamps a day.

Two features of this remarkable achievement stand out particularly as striking. In the first place each

unit lamp machine becomes a little factory in itself, performing the complete operation of manufacturing lamps, so that the closing down of any machine merely reduces output but does not affect the balance of production or interfere with any other machine or workers.

The most impressive change, however, has come in the working conditions for the girls who operate the machinery of lamp making. The old departmentalized system meant physical effort and continuous work at high speed. The unit machine has reduced the amount of work which the girls must do, at the same time that it has reduced the number of girls required. As a matter of fact, also, this saving in labor has been happily carried out without the discharging of any employees, because the natural turnover of this class of labor is high.

SAVING IN WASTE

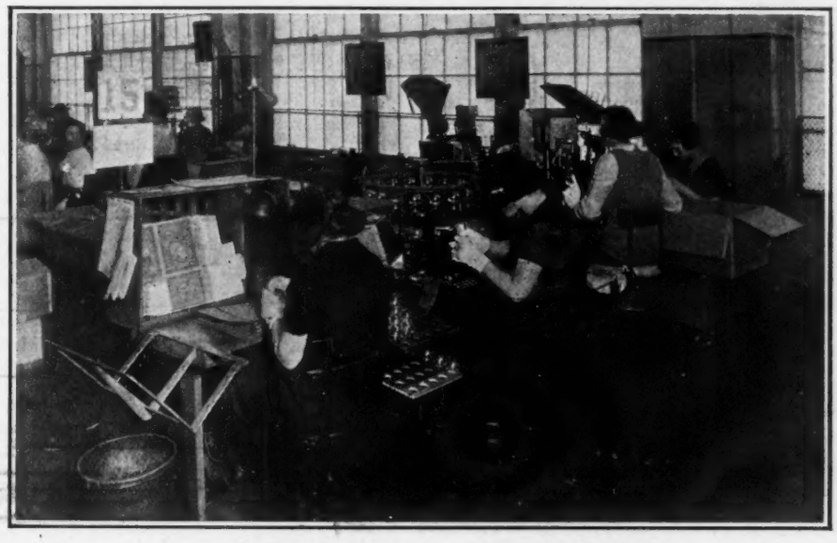
All this has also had a remarkable effect on wastage. The unit machine makes up each part and takes each step while the glass is "fresh and hot," as the lamp men say. When the glass goes in it carries through to the completed lamp without cooling. The number of defects is reduced. Also the production of each lamp is tested and inspected on the spot, imperfections can be detected and the cause run down at once, and the machine stopped for adjustment before any stock of imperfect material is turned out. In the old days a considerable quantity of some defective part would be produced before it was found by an inspector and traced to its source.

The quality of the finished lamp is not affected because the successive factory inspections and tests and the independent tests which are carried on continuously at the factory by the Electrical Testing Laboratories, Inc., operate just the same. It is the spoilage that has been reduced. The greatest saving, however, has come in floor space and in labor.

SAVING IN FLOOR SPACE

Before the coming of the unit lamp machine the Edison Lamp Works operated factories in Harrison, Belleville, Ampere and Newark, N. J.; East Boston, Fort Wayne, St. Louis and Oakland. These eight factories were operating to capacity and, as has been stated, annually produced 75,000,000 lamps. Several new factory buildings had already been erected and new land purchased to provide for the expected natural increase in business. But the improved efficiency of the unit lamp machine has made it possible to close down the Belleville, Ampere and Fort Wayne factories and sell the reserve buildings and land. It has so reduced the used floor area in the five remaining plants that whereas the yearly output is now 80,000,000 lamps, there is available in reserve sufficient additional space to increase production to a total of 150,000,000 lamps per year without adding another structure.

In a word, it has introduced an economy of 66 per cent in floor space, for where they used to make one lamp, they now make three. It has saved 50 per cent in labor. It has made possible an output of eighteen lamps per employee per hour against the former rate of nine and one-half lamps per employee per hour, and they consider it possible that they may develop a production of 25 lamps per employee per hour.



THE UNIT LAMP MACHINE, IN WHICH ALL THE PROCESSES OF MAKING A LAMP ARE COMBINED, REQUIRES ONLY FOUR OPERATIONS

FIVE PRICE REDUCTIONS

All this has been achieved, too, without adding to the burden on the help. The work has been changed over from human effort to machine production, that is all. It has also become cleaner and more pleasant work in good air with ideal factory conditions. The girls wear no overalls. Operators are carefully studied and matched into teams that are physically and temperamentally suited to work together, and it has been found that the influence is to speed up the slowest member of a unit to the team pace, rather than to pull down the team to the speed of the slowest member, in accordance with the popular belief.

The chief interest in all this lies, of course, in the fact that this remarkable decrease in the labor and factory space now required in the production of lamps has greatly lightened the cost of manufacture and led to five successive reductions in the price of lamps to the public. Within a period of thirty months Mazda lamps have been reduced in all 37 per cent. This has materially affected the cost of light to the American people and, of course, has brought a corresponding benefit to the central station and great good to the entire electrical industry, because cheaper light naturally encourages the more generous and extensive use of electrical service.

This story in its detail applies specifically to the Edison Lamp Works. Similar progress has also been made in the improvement of production efficiency in the factories of the National Lamp Works and the Westinghouse Lamp Company, although by independent action and methods that differ in some particulars. Each reduction in price has been effective for all Mazda lamps.

Freight Routing in the United Kingdom

SOME interesting and usable data on "How to Route Freight to and from Inland Points in the United Kingdom" has just been published by the Cunard Steamship Company, Limited, 25 Broadway, New York. The booklet will be found of material

assistance to electrical manufacturers in the exporting of goods to the United Kingdom. Cities having a population of over 10,000 are listed, as well as counties in the United Kingdom, and there is also a map of the British Islands and data on the Port of London Authority docks, Southampton to London service, and distances, in miles, by rail between points in England, Scotland and Wales. A copy of the booklet can be obtained by application to the steamship company.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THERE is a better tone in the electrical market. General sales have not materially increased. It is noticeable, however, that there are more inquiries and several manufacturers of wiring devices report larger sales than for several months. The upward movement in the copper and lead markets has stiffened wire and cable, and orders are quickening as buyers very wisely anticipate the rise in price that is expected about August 1. A general advance in brass products has already been announced.

Altogether the market is more confident and optimistic. It is beginning to be appreciated that although the General Electric Company, for instance, is running about 15 per cent below 1923, this is actually better than the sales of 1922, and present business falls little below a normal year. Central stations are showing more interest in purchases for fall requirements. Dealers are also beginning to place some orders for stock. Industrial business continues light.

Line material has shown the strongest market in New England, where motor sales are running about 20 per cent under last year. Prices are steady and collections are slow. In the New York district radio shows improvement over last year and building continues heavy. Business continues to improve in the Southeast and the outlook is bright.

Jobbers are doing better business than in June and more washing machines are being sold than for some years. Maintenance buying has been stronger in the Middle West, with noticeably more orders for conduit, wire and wiring devices. Conditions are better on the Pacific Coast, with good radio business and active central-station construction in the Northwest.

Trend to Greater Use of Safety Switch—Present Demand Fair

THE demand for safety switches has been fairly well maintained and orders have not dropped off to any extent. No particular section of the country is contributing to this demand, but business is being booked from all parts, with the New York territory probably slowest.

Roughly speaking, 80 per cent of the representative contractors, industrial engineers and distributors think of switches in terms of the safety type, at least in terms of the externally operated type. Not all realize the difference between the externally operated switch and the safety switch. It is interesting to note that whereas in 1920 the sales of knife switches by one representative manufacturer were 15 per cent to 20 per cent more than safety switches, at present 60 per cent to 70 per cent more safety switches are sold. There is evidence that this trend will continue, with a consequent increase in demand for safety switches.

Deliveries are very good and manufacturers have plenty of stock on hand for immediate shipments. Prices are firm and there is no indication of an advance or decline.

June Delinquent Accounts Lower

ALTHOUGH four districts reporting to the National Electrical Credit Association claimed a lower number of delinquent accounts for June over May, 1924, the average amounts increased during this period in four districts. For the central division only 889 accounts were reported for June, 1924, as against 957 for May, 1924. There was an increase during the year of 168. In New York the average amount increased from $141 in May to $147 in June, 1924, but the total number decreased from 366 to 336. Collections remain about the same in New England, where the May and June, 1924, average accounts were respectively $98.34 and $79.78.

The total list is as follows:

DELINQUENT ACCOUNTS IN JUNE

Branch and Month	Number of Accounts Reported	Total Amount	Average Amount
Central Division:			
May, 1923...	749	$95,984.35	$128.15
May, 1924...	957	110,184.35	115.13
June, 1923...	721	95,133.51	131.95
June, 1924...	889	108,723.48	122.30
New York:			
May, 1923...	437	68,228.00	156.00
May, 1924...	366	51,725.00	141.00
June, 1923...	428	50,758.00	118.00
June, 1924...	336	49,433.00	147.00
Philadelphia:			
May, 1923...	225	26,399.32	117.33
May, 1924...	327	32,961.99	100.80
June, 1923...	227	24,580.53	108.28
June, 1924...	248	28,063.46	113.16
New England:			
May, 1923...	29	3,464.08	119.45
May, 1924...	70	6,883.85	98.34
June, 1923...	29	2,325.95	80.20
June, 1924...	88	7,021.00	79.78
Pacific Coast:			
May, 1923...	20	2,910.69	145.70
May, 1924...	28	3,180.00	113.57
June, 1923...	52	13,873.41	266.80
June, 1924...	22	3,877.39	176.25

Demand for Lead-Covered Cables Keeping Up Well

THE demand for lead-covered cables is keeping up well, although it is below normal, according to manufacturers. However, cables used in connection with street illumination and high-tension work are enjoying a brisk demand. The outlook for fall and winter business is very good.

The tendency appears to be for an increased demand for rubber-covered cable in the smaller sizes and for low-tension work in preference to varnished cambric cable, whereas this condition is reversed with the larger sizes. Prior to the slowing down of general business there was a pronounced tendency for industrial plants to use lead-covered cable in installation work and a general increase of its use is expected. In fact, in certain localities, the use of lead-covered cable is required by local ordinances in industrial plants. The expansion of central-station systems and the elimination of overhead wires in congested districts have also helped materially in creating a demand. The use of lead-covered paper cables on higher voltages is gradually increasing, but as a large field experience is necessary to determine results progress in this direction must necessarily be slow.

Deliveries at the present time are very good, as they depend almost entirely upon the volume of business, and manufacturers are not as busy now as they were earlier in the spring. The majority of deliveries are being made on promised time, which are prompt in the case of rubber and vary from four to eight weeks in the case of varnished cambric. Prices are very low in rubber-covered cables, due to the low cost of material used, and the very severe competition existing for the business offered. With copper and lead prices now rising some changes may develop.

Steady Demand for Potheads—Good Deliveries—Prices Firm

THE demand for potheads has held up particularly well and there has been very little falling off in sales of this line of equipment. This would seem to indicate that more lead covered cable is being used. Although construction work is being curtailed in some cases there is apparently urgent work in sufficient volume to maintain the demand. Further, manufacturers of this apparatus do not see any likelihood of a falling off at any time soon and they believe that future demand should steadily increase. Underground construction, which requires the use of potheads, is being developed to greater refinement and as a result will entail more extensive use of this material.

Deliveries are very good indeed as adequate stocks are carried to meet demands. As it is not possible to get deliveries on a new design of porcelain in much less than ten weeks, wherever there is a requirement for special porcelain design deliveries are accordingly lengthened. No price revisions are contemplated and prices are level, being now practically on the 1921 basis. Porcelain is the main cost factor of

potheads, so that any price reductions in porcelain will affect pothead prices almost correspondingly.

Metal Market Improves—Copper and Lead Prices Advance

METALS are selling in good volume and with the exception of zinc, it has been a week of increasing prices. Copper and lead have continued to advance. Copper sold up to 13¼ cents on Monday and Tuesday, but eased off in sympathy with the London market. The volume of business has been good with a strong export demand, which is about on a parity with the domestic level.

The official contract price of the American Smelting & Refining Company for lead was advanced from 7.25 to 7.50 cents, New York, on Tuesday, July 29. With this increase in price there was a falling off in the volume of inquiries and orders that have been flooding the producers, a demand that was felt to be largely speculative. There is an ample supply of lead, but it is being fed out gradually. No great improvement in orders for finished lead materials is expected much before September.

NEW YORK METAL MARKET PRICES

	July 23, 1924 Cents per Pound	July 30, 1924 Cents per Pound
Copper, electrolytic	12.90	13¼
Lead, Am. S. & R. price	7¼	7½
Antimony	8¼	8¼
Nickel, ingot	27	27
Zinc, spot	6¾	6¾
Tin, Straits	18	49¼
Aluminum, 98 to 99 per cent	26¼	27

The zinc market is quiet. Several export orders have been booked, but the tonnage is under that reported for last week. Galvanizers are showing little interest.

Central-Station Buying Sustains New England Trade

PURCHASES of line material for central station expansion was the striking feature of the Northeastern market at the beginning of the week. Even in communities dominated by manufacturing industries that are experiencing dull business the addition of new customers by electric utilities goes merrily forward. New building requirements are running below those of last year, but a large volume of routine sales of material for use by contractors is booked weekly in this territory, even if the total is not spectacular.

Wiring devices are moving on what is alleged to be a very narrow profit margin. Appliances showing fair activity include fans, electric heaters, flatirons, ranges and water heaters. Central stations are buying storage batteries for oil-switch control in healthy volume, but the sale of radio and truck batteries is dull. Motor sales in New England are about 20 per cent under last year's figures. Prices are steady in most lines and firm in wire quotations, with an upward tendency anticipated by representative jobbers. Collections are seasonably slow.

Better Tone in New York District —Manufacturers' Sales Grow

JOBBERS in the New York district report little increase in sales, but there appears to be a better tone to the market and not much more than the seasonal drop which is expected in July and August of a normal year. Building is still heavy, and there is good demand for electrical goods for finishing up construction jobs which were begun last spring. Unfavorable weather conditions have crippled fan business, but radio is running better than last year with stocks low and the trade optimistic and healthy. There is little industrial buying. Central-station purchasing is quiet, with some exception in the appliance line, where active promotion work has maintained public interest. Flatirons are selling best. There are indications, however, that the utilities are somewhat freer in the consideration of fall needs and may be expected to increase general purchasing. Dealers are buying appliances quite actively for fall business.

The upward movement of the copper market has stiffened the wire and cable situation, and there has been a pick-up in both inquiries and sales. An advance in price is looked for about August 1. Manufacturers, particularly of wiring devices, are feeling a stronger confidence in the market. In one case the last two weeks have brought better business than has been seen for several months past, sizable stock orders having been received from six jobbers within a few days. Another reports a quickening business for the last three weeks, and a manufacturer of safety switches reports improved sales. Poles are reported very quiet.

Good Business in the Southeast—Construction Materials Strong

GENERAL business conditions in the Southeast continue to improve, with the outlook apparently bright in all lines. The tone in the rural districts will be even better with the marketing of the tobacco crop, the value of which in Georgia ranks second only to that of cotton. Electrical jobbers report their business highly satisfactory, and in excess of June, particularly in fans, small appliances and ranges. Educational work by manufacturers and sales campaigns by central-station companies have caused the movement of washing machines to pick up, and sales of this specialty are the best that have been recorded for several years. The extensive building program that is under way and the expansion of power-company systems are reflected in the demand for construction materials.

Purchases of industrial equipment, especially by steel and textile mills, are somewhat slow on account of the general conditions of these industries, but the increase in the number of inquiries indicates a more optimistic feeling on the part of the operators and forecasts a return to more normal conditions in the fall. Coal-mining operations are at a low ebb, and this has served to reduce the volume of purchases from this class of business. As a result storage-battery interests report a sharp falling off in the demand for batteries for mine locomotive equipment, but orders from terminal companies for batteries for railway-terminal trucking equipment are satisfactory. General stocks in the district are good.

Rising Market on Most Commodities in Middle West

GENERAL business continues on the upswing in the Middle West, and the low point in depression appears to have passed. There has been more purchasing of major lines, including steel, leather goods and dry goods. A stiffening in copper and cotton and improvement in agricultural prices are reported.

The increase of one-half cent per pound base on copper announced last week equals an increase of about 10 cents per 1,000 ft. alone on No. 14 wire, and, with an increase of fifty points on cotton, wires and cables, tapes and cotton goods probably will advance shortly.

Maintenance purchasing has been especially heavy with the utilities, and orders are being placed for somewhat longer periods. The usual seasonal increase in inquiries for goods and service is helping the jobbing trade to feel optimistic. Conduit sales increased and the demand for wire and wiring devices was noticeably heavier. Better-lighting campaigns apparently are having their effect. One extensive program of street lighting is now being contemplated.

Pacific Coast Conditions Improve —Building Active in Northwest

BUSINESS on the Pacific Coast, though still only fair in comparison with this period of last year, can nevertheless be said to be improving, with a very perceptible return toward optimism. Dealers' stocks have been reduced to a minimum which even now appears inadequate not only in counter lines but in the larger appliances, and an excellent last quarter is being predicted. There is a brisk market on radio specialties such as small charging rectifiers, of which there is once more stock on the Pacific Coast, and also in type B batteries, which recently decreased 33⅓ per cent in price. Weatherproof wire has dropped 1 cent per pound to a local three-braid base price of 20 cents a pound, but subsequent advances of copper and cotton seem to indicate that the rock bottom has been reached in all copper-wire prices. Electrical business is being decidedly improved by constructive engineering and advisory work. Several carloads of conduit, for instance, have recently been sold in Los Angeles territory for use in street-lighting projects.

In the Northwest building continues active and contractor-dealers are busy on this new work. Sales to them by jobbers are showing constant increase from week to week. Competition is keen, but the prices at which jobs are being taken are not permitting much profit. Power development in the Puget Sound district is active. Central-station companies there are engaged in a considerable amount of extension and improvement work, and this activity is expected to continue into fall. Contractors report collections generally good.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Hoover Sweeper Holds International Convention

The "fourth international Hoover convention" was held at North Canton, Ohio, by the Hoover Suction Sweeper Company from July 8 to 19, in two sections. The first week was the "salesmen's section," for men who had reached and exceeded a high quota of sales, and there was an attendance of 325 men, these including fourteen men from Canada and twenty-two from Europe. This week was devoted largely to a review of selling methods and practices.

The second week was devoted to managers and supervisors, of whom 375 were present, with a large Canadian and European attendance, and to presenting plans and discussing methods for conducting supervisory work. President H. W. Hoover, in taking into account the situation of the last few months, presented figures showing that even in times that are considered hard not more than 12 per cent of the population is without employment. This 12 per cent is largely that class which does not live in electrically wired homes, and the dealer in electrical appliances can therefore regard the present-day market as being substantially normal. He suggested as a slogan for dealers, for salesmen and for all who in any way are connected with appliance selling: "Mix hard times with hard work."

Curtis Lighting, Inc., Appoints Two New Resident Engineers

The appointment of two new resident engineers to give illumination service in the field is announced by Curtis Lighting, Inc., Chicago. Karl Anton Piez, with offices at 146 Summer Street, Boston, will be available to all New England states. George P. Prichett at 510 Securities Building, Des Moines, Iowa, will assist Harvey B. Wheeler in Iowa and Nebraska.

Allis-Chalmers Furnishing Turbines for New Plant

The Allis-Chalmers Manufacturing Company, Milwaukee, has just received an order for the new station of the California Oregon Power Company, Medford, Ore., embracing two vertical-shaft Francis turbines rated at 20,000 hp., under 140 ft. net head, at 171 r.p.m., of the Allis-Chalmers circular-section, plate-steel, spiral-casing type and with the concrete type of White hydraucone. The equipment also includes the governors and the oil-pumping system.

Westinghouse hydro-electric generators of the two-bearing type will be used, for which Allis-Chalmers will furnish cast-iron supporting barrels between the speed ring of the turbine and the stator of the generator so as to insure the self-contained alignment of both parts. It is expected that this plant will furnish energy by May 1, 1925, the whole output being contracted for delivery to the power system of the Pacific Gas & Electric Company, San Francisco. This is the third hydraulic plant which Allis-Chalmers has furnished to this company, the first being Copco No. 1, which comprised two 18,600-hp. units, and the second being the 4,000-hp. unit for the Klamath Falls plant, in which an Allis-Chalmers generator was also used. This plant is about ready to be started.

Welsbach Company to Enter Electric Street Lighting Field

The Welsbach Street Lighting Company, Philadelphia, for more than twenty-five years specializing in gas street lighting, intends to extend its services to include electric street lighting. Through co-operation with the principal electric industries and central-station companies it will undertake the development and maintenance of the existing as well as the construction of the most modern street lighting systems. The aim of the organization, which is national in scope, is to give municipalities the most efficient and economical street lighting service possible.

The company has secured the services of the former electrical engineer of the District of Columbia, Walter C. Allen, who had charge of the street lighting system in that district for more than twenty-two years, and under whose direction most of the modern lighting in that city has been installed. Mr. Allen will have immediate charge of the new branch of the Welsbach company's operations and will bring to his new duties not only the extended experience he has had in this special line of work but the added experience in municipal and public utility activities gained during the past eight years as executive officer of the Public Utilities Commission of the District of Columbia. Mr. Allen is a graduate in civil engineering from the University of California and is a member of the Illuminating Engineering Society and an associate member of the American Institute of Electrical Engineers.

Westinghouse Will Furnish Equipment for "Copco" Plant

The Westinghouse Electric & Manufacturing Company has received a large equipment order for the new Copco plant No. 2 of the California Oregon Power Company. It will include two 15,000-kva., 6,600-volt, 171-r.p.m. vertical waterwheel generators with direct-connected exciters; four 10,000-kva. water-cooled, 130,000-volt high-tension, 6,600-volt low-tension transformers, and complete high and low-tension switching apparatus for the above generators and transformers.

The transformers are somewhat out of the ordinary in that they are designed to transform simultaneously 10,000 kva. from 6,600 volts to 130,000 volts and 10,000 kva. from a 66,000-volt tie-in line to 130,000 volts.

Square D Company Closes Most Prosperous Period in History

The Square D Company, Detroit, announces through T. J. Kauffman, treasurer and general manager, that the six-month period just closed in June, 1924, was the most prosperous in the history of the company, which has for the last ten years been manufacturing its present-type safety switches. A porcelain plant in Peru, Ind., which was purchased in 1920, has been in continuous operation ever since, despite the fact that, although the plant had been in existence more than twenty years, it had never enjoyed four years' continuous operation prior to its acquisition by the Square D Company.

Mr. Kauffman reports present business good and the outlook very favorable.

Link-Belt Expands Executive Personnel

The Link-Belt Company, Chicago, has announced a number of important changes in its executive organization. The company is now operating nine plants and twenty-five sales offices, and as a result of the acquisition of additional plants and a large extension in its lines of manufacture in the last five years a partial decentralization of executive functions seemed desirable. At a meeting of the board of directors on July 24 the chairman of the board was made the chief executive officer of the company, and an executive committee of four was created to act in an advisory capacity to the officers. President Charles Piez was elected chairman of the board and chairman of the executive committee, and Alfred Kauffmann, second vice-president of the company, was elected president. President Kauffman, Staunton B. Peck, elected senior vice-president, and Thomas B. Marston, a member of the board of directors, were selected as the other three members of the executive committee. Mr. Peck will direct and supervise operations and sales in the Eastern district. Arthur C. Johnson was elected second vice-president and remains in charge of operations and sales in the Western district. Humphrey J. Kiely was elected third vice-president and continues in charge of exports and sales in the New York district.

Mr. Kauffmann has been with the Link-Belt Company for twenty-four years, beginning in the engineering department and moving successively through the construction department, the general office as assistant to the president, the managership of the Philadelphia plant, and to the position of vice-president in charge of the com-

pany's large Indianapolis operations. For the present his headquarters will be at Indianapolis, where the company's largest operations are centered.

Norma Company of America Changes Its Name

In order that it may realize the fullest value from its nationally advertised trademarks — "Norma" and "Hoffmann"—as well as better to describe the nature of its business, the Norma Company of America, of Long Island City, N. Y., has changed its corporate name to Norma-Hoffmann Bearings Corporation, with the same management, personnel and policies as heretofore.

About twelve years ago the "Norma" ball bearing was introduced in America as the first "precision" bearing ever offered the American trade. Its sale therefore involved also the sale of the idea of precision and its value in the industrial world. The new bearing found its first market in the automotive field for use in high-speed magnetos and lighting generators and later in fractional-horsepower motors, small generators, vacuum cleaners, electrical utility motors, measuring and recording instruments, grinders, drills and other small tools.

Some two years ago the company acquired the American rights in the patents, trademarks and business of the Hoffmann Manufacturing Company, Ltd., of Chelmsford, England—one of the largest and best-known manufacturers of precision roller bearings in the world.

To provide for the constantly growing demand for "Norma" precision ball bearings and to permit the manufacture of "Hoffmann" precision roller bearings and "Hoffmann" steel rollers, the company has just completed a new and modern plant on its seventeen acres of property at Stamford, Conn., on the main line of the New Haven railroad.

International Combustion Earnings Expected to Double

The International Combustion Engineering Corporation, 43 Broad Street, New York, during the first six months of 1924 is expected to more than double its earnings as compared with the corresponding period of 1923. This is all the more noteworthy as the first half usually runs considerably lighter with this company than the last six months.

Domestic business is running at record figures. Unfilled orders should approximate $7,000,000, or about $1,000,000 more than at the beginning of the year. There has been no let up in orders since the end of last year and inquiries and orders have been increasing each month. A number of large contracts are being figured on at the present time and these are expected to be closed in the near future. Vickers-International, a subsidiary of the International, during the last month closed contracts totaling $2,000,000.

The **Square D Company**, Detroit, Mich., manufacturer of "Square D" safety switches, announces the appointment of J. J. Mitchell as sales manager in the St. Louis district, with headquarters at St. Louis, Mo. Mr. Mitchell was formerly in charge of Square D sales in the Indianapolis territory and replaces E. F. Bollinger, who has resigned from the company. H. P. Riddell has been made branch sales manager in the Indianapolis territory.

Westinghouse War Memorial Scholarships.—The recipients of War Memorial Scholarships annually offered by the Westinghouse Electric & Manufacturing Company have been announced as follows: Homer C. Porter, Robert W. Richards, Robert E. Patterson, and Samuel D. Reynolds. The four scholarships are established annually by the Westinghouse company as a memorial to those employees of the company and its subsidiaries who entered the service during the World War. Each scholarship carries with it an annual payment of $500 for a period which is not to exceed four years, such payment to be applied by the recipient to an engineering education in a technical school or college.

The Delco Light Company held the annual sales conference of its Southeastern distributors at the Biltmore Hotel in Atlanta on July 21 and 22, with an attendance of forty. It was announced at this meeting that 1923 sales doubled those of 1922 and the prospects were that 1924 would double 1923 sales.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Spur-Gear Speed Transformer

An "Industrial type" spur-gear speed transformer for use in connection with conveyor drives, in pulp and paper mills, steel plants, etc., and designed for continuous or heavy service applications has been developed by the Hill Clutch Machine & Foundry Company, Cleveland, Ohio. The speed transformer consists of a nest of plain spur gears revolving in oil, changing the r.p.m. of the input shaft to the desired r.p.m. of the output shaft.

The high and low speed shafts are supported in double bronze bearings, and ordinary thrust conditions have been provided for. Both shafts are also in identical axial alignment. The speed transformer is made in seven sizes.

Highway Signals

A number of illuminated highway "stop" and "direction" signals for use at the intersections of streets, highways and railroad crossings have been developed by the Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago. The units are all weatherproof and are equipped with a reflector for illumination of the sign and in addition are fitted with a bullseye colored lens as a warning signal. They are arranged for operation on multiple circuits or on series circuits with single-unit transformers.

Arc-Welding Rheostat—A new arc-welding rheostat, compact and of light weight, has recently been developed by the Westinghouse Electric & Manufacturing Company. The resistance element consists of a number of alloy resistor units supported horizontally and thoroughly insulated from the welded angle iron frame. When the rheostat is connected to any trolley line voltage between 400 volts and 650 volts it will deliver from 60 amp. to 210 amp. in fifteen steps. The control panel is mounted on the front and is protected from the resistor units by a metallic heat shield. This panel contains a 250-amp. magnetic contactor which is remotely controlled by a foot master switch. Four single-pole knife switches are also mounted on the panel for obtaining the required variations of welding current.

Thermo-type Instruments.—Portable thermo-type voltmeters and milliammeters for use on high-frequency circuits of moderately low capacity and also low-voltage, alternating-current measurements of ordinary frequencies have been placed on the market by the General Electric Company. The D'Arsonval instrument element mounted in a standard is used, actuated from a vacuum thermo-couple located inside the carrying case. Voltmeters are being made in ranges from 0.75 volts to 150 volts and milliammeters can be built for either 20, 25 or 30 milliamperes. The voltmeters are designed to stand loads of 25 per cent to 50 per cent in excess of the normal ratings. All the instruments are highly damped. The resistance of the voltmeters is approximately 40 ohms per volt.

Sump Pump.—A standard sump pump, completely assembled, including motor, starter and float switch, built in one size only, and for use in draining cellars, pits, etc., has been developed by the Goulds Manufacturing Company, Seneca Falls, N. Y. The pump is carried in stock completely assembled and is automatic in operation. The pump, being submerged, is always ready to start.

Automatic Electric Range.—An automatic electric range identified as "RA 101" has been announced by the Edison Electric Appliance Company, Inc., 5600 W. Taylor Street, Chicago. The range is equipped with automatic temperature control and indicator, three-heat elements and a white porcelain cooking top and panels. Three interchangeable 6¾-in. heating disks, each rated at 250, 500, 1,000 watts, and two oven units, rated at 300,600, 1,200 watts are provided.

New Trade Literature

DATA ON VALUATION OF PUBLIC UTILITIES.—The American Appraisal Company, Milwaukee, has issued a booklet entitled "Public Utility Valuations" in which it seeks to give an outline whereby the basic data regarding the fair value of utilities can be brought to light and presented with the proper substantiation of details in any litigation wherein values are involved. "When Insurance Insures—and When It Doesn't" is the title of a new booklet issued by the company in which it shows property owners how to determine the value of property to be insured. It also gives a form for a summary giving all the information necessary in placing insurance accurately and economically.

PULVERIZED-FUEL SYSTEM.—A catalog describing the "Lopulco" pulverized-fuel system and containing a detailed description of a plant equipped with the system, as well as another catalog describing the "Raymond" pulverizer, has been issued by the Vickers & International Combustion Engineering, Ltd., Africa House, Kingsway, London, W. C. 2.

CIRCUIT BREAKERS.—Bulletin No. 560 issued by the Roller-Smith Company, 233 Broadway, New York City, covers its "Safety" circuit breakers, inclosed type P, and non-closable on overload, type E.

FIRE PROTECTION.—The Foamite-Childs Corporation, 629 Turner Street, Utica, N. Y., is distributing a booklet entitled "Dipping Dangers," describing its automatic "Foamite" engine system for fire protection in industrial plants using dip tanks, tempering vats, dry-cleaning tubs, open oil storage, etc.

DETACHABLE COLOR GLOBES.—The Universal Electric Stage Lighting Company, Inc., 321 West Fiftieth Street, New York City, has issued bulletin KA, covering its detachable-color-globe type border light.

STARTERLESS MOTOR.—Bulletin No. 133, issued by the Wagner Electric Corporation, St. Louis, describes and illustrates its "Pow-R-full" starterless motor. It also gives an outline of the development of the induction motor and various uses in connection with it.

CARBON PRODUCTS.—The National Carbon Company, Inc., 30 East Forty-second Street, New York City, is distributing a new catalog covering the "National" carbon products. It is published in loose-leaf form, thus allowing changes and additions to be made from time to time.

GROUNDING SERVICE.—The Groundlet Company, 86 Park Place, Newark, N. J., has issued a booklet entitled "Groundology," which contains an article on "Protective Grounding of A.C. Services."

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Durban, South Africa (No. 11,085), of automobile accessories, spotlights, spark plugs, etc.

Purchase is desired in Johannesburg, South Africa (No. 11,073), of batteries in rubber-cased boxes for automobiles and unassembled batteries.

An agency is desired in Wellington, New Zealand (No. 11,061), for electrical apparatus, including generators, motors, switchgear, insulators, house fittings, wire, etc.; (No. 11,093), for electrical fittings, such as switches, ceiling roses and conduit cable.

Purchase and agency is desired in Alexandria, Egypt (No. 11,072), for radio equipment.

An agency is desired in Malaga, Spain (No. 11,110), for Diesel engines and semi-Diesel engines, from 60 hp. to 300 hp.

Purchase and agency is desired in Wellington, New Zealand (No. 11,114), for ventilating machinery.

An agency is desired in Vienna, Austria (Nos. 11,101 and 11,100), for electrolytic copper.

TURBO-ALTERNATOR FOR WHITE BAY (AUSTRALIA) POWER HOUSE.—Tenders will be received by the New South Wales Government Railways and Tramways, Sydney, until Oct. 15 for a 20,000-kw. turbo-alternator for the White Bay power house.

EQUIPMENT FOR HYDRO-ELECTRIC PLANT FOR MENDOZA, ARGENTINA.—Tenders will be received by the Argentine National Sanitation Works Department until Oct. 6 for turbines, three-phase generators, switchboard, etc., in connection with the hydro-electric plant for the town of Mendoza, Argentina.

AUTOMATIC TELEPHONE SYSTEM FOR CAIRO, EGYPT.—The Egyptian State Railways and Tramways Department, Cairo, Egypt, will receive tenders until Oct. 30 for automatic telephone exchange equipment and substation at Cairo.

New Incorporations

THE AUBURNDALE POWER COMPANY.—Munsey Building, Baltimore, has been incorporated by Herman A. Lang, Joseph A. Slattery and Elsie P. Wagner to generate and supply electricity in the town of Auburndale, Fla.

THE DUKE-PRICE POWER, COMPANY, Ltd., Quebec, has been incorporated with a capital stock of $1,500,000 for the purpose of generating and transmitting electricity in the Province of Quebec. J. B. Duke, New York City, and William Price, Canada, are incorporators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Boston Elevated Railway Company plans to build a substation on Washington Street in the Forest Hills district.

FITCHBURG, MASS.—The Grant Yarn Company plans to rebuild its power house, recently damaged by a hurricane, with loss of about $19,000.

MONTAGUE, MASS.—The Board of Commissioners, Turners Falls Fire District, contemplates the construction of a local light and power plant for commercial service.

Middle Atlantic States

BRONXVILLE, N. Y.—Bids will be received by the Bronx Parkway Commission, 72 West Pondfield Road, until Aug. 11, for installing a complete lighting system throughout the Bronx River Parkway Drive between the Botanical Garden in the Borough of the Bronx and Kensico Dam in Westchester County, a distance of about 15½ miles. Lighting standards will be furnished by the commission. About 470 lamps will be required in the complete installation. Bids will be received on the following types of underground distribution: (a) Steel-taped, lead-incased primary cable, known as solid construction; (b) steel-taped, lead-incased primary cable, known as semi-solid construction; (c) rubber-covered, lead-incased primary cable in fiber conduits enveloped in concrete; (d) rubber-covered, lead-incased primary cable installed in concrete conduit, known as the "Murray" conduit. Jay Downer is engineer and secretary of the commission.

BUFFALO, N. Y.—The City Council is considering a recommendation submitted by the Public Works Commissioner for installing luminous-arc lamps on Main Street from the water front to Carlton Street and in Seneca and Exchange Streets from Main Street to Michigan Avenue. It is proposed to replace 115 lamps mounted on 22-ft. standards with 315 lamps on 14½-ft. standards.

ITHACA, N. Y.—The New York State Gas & Electric Corporation, which has been granted permission to extend its electric lines and exercise franchises in certain municipalities of southern and southeastern New York, plans to erect a 110,000-volt transmission line from the Adirondack Power & Light Corporation lines at St. Johnsville to its plant at Colliers in order to supply the additional electricity required.

MANLIUS, N. Y.—Negotiations are reported to be under way between the Syracuse Lighting Company and the estate of Willard J. Phillips for the purchase of the electric properties and franchises covering the towns of Manlius, Pompey, Chittenango and Sullivan owned by the estate.

MIDDLETOWN, N. Y.—The Rockland Light & Power Company, Nyack, has applied to the Public Service Commission for permission to purchase the property of the Orange County Public Service Company, including both the developed and undeveloped power sites. It proposes to connect its lines with those of the Orange county company and the Orange & Rockland Electric Company, Monroe. The company has also asked for authority to increase its capital stock from $2,400,000 to $5,400,000.

NEW YORK, N. Y.—The New York Central Railroad Company has filed plans for the construction of a substation, on South 241st Street, to cost about $42,000.

NEW YORK, N. Y.—The New York Edison Company has filed plans for the construction of a switching and distributing station at 122 West Twenty-third Street, to cost about $145,000. William Whitehill, 709 Sixth Avenue, is architect.

NEW YORK, N. Y.—Bids will be received by Thomas J. Brennan, fire commissioner, Eleventh Floor, Municipal Building, until Oct. 5, for construction of a portion of the underground fire-alarm system, Borough of the Bronx.

NEW YORK, N. Y.—Bids will be received by the superintendent of school buildings, Board of Education of the City of New York, corner of Flatbush Avenue Extension and Concord Street, Brooklyn, until Aug. 5 for electric wiring and fittings, and for gas and electric fixtures for an addition to High School of Commerce, corner of Sixty-fifth Street and Amsterdam Avenue, borough of Manhattan.

NEW YORK, N. Y.—Bids will be received by the superintendent of school buildings, Board of Education of the City of New York, corner of Flatbush Avenue Extension and Concord Street, Brooklyn, until Aug. 8 for installing an electric passenger elevator in Public School 62, and in the Stuyvesant High School, both in Borough of Manhattan, and in the Commercial High School, Borough of Brooklyn. Bids will also be received at the same date for electric wiring and fittings, and for gas and electric fixtures for new Public School 83, on Rhinelander Avenue and Radcliffe Avenue, Borough of the Bronx; also for electric wiring and lighting fixtures for addition to Public School 95, Jamaica, Borough of Queens.

NORTH TONAWANDA, N. Y.—The Tonawanda Power Company will build a steel tower transmission line from its distributing station on Robinson Street to the substation at Main and Sommer Streets.

OSWEGO, N. Y.—Extensions to the street-lighting system, to cost about $5,000, are under consideration by the City Council.

ROCHESTER, N. Y.—The Public Service Commission has granted the Rochester Gas & Electric Company permission to extend its transmission lines and exercise franchises in the towns of Walworth, Hopewell and Canandaigua.

SHERRILL, N. Y.—The Kenwood (N. Y.) Electric Company is planning to build a steam-driven electric plant in Sherrill.

THERESA, N. Y.—Bonds to the amount of $15,000 have been voted for improvements to the municipal electric plant, including the installation of a waterwheel, construction of dam and breakwater. An issue of $5,000 in bonds was authorized to purchase new pumping equipment to be electrically operated.

VERNON, N. Y.—The Kenwood (N. Y.) Electric Company contemplates building a steam-driven electric plant in Vernon.

JERSEY CITY, N. J.—Colgate & Company, 105 Hudson Street, contemplate the construction of a power plant in connection with their soap-manufacturing works at Vera Cruz, Mexico, to cost about $1,000,000.

NEWARK, N. J.—The Board of Education, Essex County Vocational Schools, 475 High Street, plans to install an electrical shop, with power and industrial electrical equipment, at the proposed vocational high school at Irvington, Newark, to cost about $200,000. Electric equipment will also be installed in other shop departments. Bids for erection will soon be called. Guilbert & Betelle, Chamber of Commerce Building, are architects.

WHIPPANY, N. J.—The Agar Manufacturing Corporation, 167 Forty-first Street, Brooklyn, N. Y., plans to build a power house at its proposed local plant, on which work has been started.

ERIE, PA.—Plans have been filed by the Erie County Lighting Company for the construction of a new office building, to cost about $100,000.

FRANKLIN, PA.—The Venango Public Service Corporation has applied for permission to acquire and consolidate twelve light and power companies operating transmission lines and systems in Clarion and Crawford Counties.

PHILADELPHIA, PA.—Bids will be received by the quartermaster, Marine Corps, until Aug. 4, for 5,000 flashlight batteries.

PHILADELPHIA, PA.—The Arguto Oilless Bearing Company, 149 West Berkley Street, has filed plans for the erection of a power house at its plant. Harris & Richards, Drexel Building, are architects.

PHILADELPHIA, PA. — The Kaufman Plush Company, Pensdale and Mitchell Streets, has taken out a permit for an addition to its power house in connection with mill extensions, for which a general contract has been awarded.

TREXLERTOWN, PA.—A movement has been started to secure an electric lighting system for Trexlertown.

WAYNE, PA.—The Wayne Township, Jackson Township, Rush Township and Jefferson Township Electric companies are being organized to erect transmission systems in the respective districts, for which named. Byron A. Milner, Real Estate Trust Building, Philadelphia, attorney, represents the companies.

WILLIAMSTOWN, PA.—The Eastern Pennsylvania Light, Heat & Power Company plans to extend its transmission lines in this vicinity. The local power plant of the Lykens Valley Light & Power Company, recently acquired, will be discontinued. The company is reported to be considering the construction of a hydro-electric plant on the Juniata River, near Iroquois.

YORK, PA. — The Gilbert Wall Paper Company, South Linden Avenue, plans to build a power house in connection with a proposed plant on State Street. J. A. Dempwolf, Casset Building, is architect.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company has applied for a permit to construct a substation at 626-32 Forrest Street.

ABINGTON, VA.—A special election will be held on Aug. 5 to vote on the proposal to issue bonds for the purpose of establishing a municipal electric lighting system and waterworks.

PULASKI, VA.—The Pulaski Furniture Company plans to build a power house at its proposed local plant. The entire cost is estimated at $300,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 5 for storage-battery testing outfits, sound-transmitting outfits, riveting machine, etc.

North Central States

DETROIT, MICH. — The Ford Motor Company, Highland Park, plans to install electric power equipment at its proposed steel-mill unit on Miller Road, River Rouge works, to cost about $600,000. Albert Kahn, Marquette Building, is architect.

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company has been granted a permit to build a substation to cost about $75,000, adjacent to its present building on Euclid Avenue, near Ivanhoe.

DELAWARE, OHIO.—Steps have been taken by the Chamber of Commerce for the installation of new street lamps on several streets in the city. The cost is estimated at $11,000.

NORWALK, OHIO. — A new 500-hp. boiler is being installed in the municipal electric plant. M. G. Irvin is superintendent of electric department.

SYDNEY, OHIO. — The Ohio Electric Power Company, recently organized to acquire the properties of the Oberlin (Ohio) Gas & Electric Company and the Ravenna (Ohio) Gas & Electric Company, has authorized an issue of $750,000 in bonds, subject to the approval of the Public Utilities Commission, the proceeds to be used to take over the above plants. The properties are operated by the Albert Emanuel Company, Inc., 61 Broadway, New York.

TOLEDO, OHIO.—The City Council has authorized the installation of an ornamental lighting system, consisting of eighty-nine lamps, on Sylvania, Phillips and Detroit Avenues, from Jackman Road to Walcott Boulevard; also twenty lamps on Washington Street, between Summit and Michigan, and ten lamps in Home Acres.

INDIANAPOLIS, IND.—The Interstate Public Service Company has applied to the Public Service Commission for authority to condemn about 500 acres of land in Elkhart County on the Elkhart River for sites for proposed hydro-electric plants, to be located at Benton and Upper Benton.

SPRINGFIELD, ILL.—The Illinois Power Company is considering the construction of a local substation, to cost about $175,000.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation contemplates installing an additional 5,000-hp. generating unit in its local plant. A. G. Carson is assistant general manager.

GREEN BAY, WIS.—The City Water Department contemplates establishing water pumping station at wells in various parts of the city to be equipped with electrically-operated pumps, instead of centralizing the pumping station as heretofore.

JANESVILLE, WIS.—Arrangements are being made by the Wisconsin Power, & Light Company for the erection of a transmission line from the Avalon-Emerald Grove branch line, about 5 miles long, to supply electricity to residents in the vicinity of Rock Prairie.

MANITOWOC, WIS.—Plans have been approved by the City Council for extending the transmission lines of the municipal electric system to supply electrical service to consumers outside of the city limits.

OSHKOSH, WIS. — Plans have been adopted by the City Park Board for the installation of thirty ornamental lamps in Menominee Park and fifty in South Park.

RHINELANDER, WIS.—Council is considering the installation of an ornamental lighting system on Brown Street.

ALEXANDRIA, MINN.—Bids will be received by the Board of Public Works until Aug. 7 for an addition to the municipal power plant, as per plans and specifications on file at the office of the Charles L. Pillsbury Company, Minneapolis, engineer. H. S. Campbell is city clerk.

FORT DODGE, IOWA.—The City Council has adopted resolutions providing for the installation of an ornamental street-lighting system on First Avenue from North Third to North Twelfth Street and a number of intersecting streets. C. H. Reynolds is city engineer.

GRINNELL, IOWA.—The Iowa Southern Utilities Company, Centerville, has acquired the property of the Iowa Light, Heat & Power Company at Grinnell and seven nearby towns.

HAWARDEN, IOWA.—At a special election held recently the proposal to issue $50,000 in bonds for the construction of a new municipal electric light plant was carried.

JEFFERSON, IOWA.—The Iowa Railway & Light Company, Cedar Rapids, has applied for a franchise to erect and operate transmission lines in Bocne and Green Counties.

KENNETT, MO.—The Arkansas-Missouri Power Company plans to erect a transmission line from Kennett to Rector, Ark.

ST. LOUIS, MO.—The Union Electric Light & Power Company has applied for a permit to build a substation on North Eighth Street, to cost about $33,000.

JAMESTOWN, N. D.—The Council is considering a petition for the installation of an ornamental lighting system on a portion of Third Street.

MADISON, S. D.—The Council is planning to install an ornamental street-lighting system on portions of First Street and Egan Avenue.

VIBORG, S. D. — The Viborg Electric Service Company contemplates erecting some lines into the farming district.

Southern States

DAVIDSON, N. C.—The Town Council is considering a bond issue of $25,000, part of the fund to be used for the installation of a municipal electric light and power system, including substation, etc.

SOUTHERN PINES, N. C.—Bids will be received by the Mayor and Board of Town Commissioners until Aug. 26 for construction of waterworks and sewage-disposal plant. The work will consist of a pumping station and complete filter plant, water tank and tower, 3 miles of 2,200-volt transmission line, motor-driven centrifugal pumps and accessories, impounding dam and sewage-disposal plant. The Gilbert C. White Company, Durham, is engineer.

COLUMBIA, S. C.—The General Gas & Electric Corporation, 50 Pine Street, New York City, has purchased the property of the Columbia (S. C.) Railway, Gas & Electric Company, including its subsidiaries, the Parr Shoals Power Company, Columbia Gas Company, Central Carolina Power Company and the South Carolina Power Company. The plans of the purchasers include the erection of a transmission system to connect the two sections, which lie about 100 miles apart, together with the construction of a new steam-driven generating plant and an additional hydro-electric plant to provide for the further development of business.

COLUMBUS, GA.—Work has started on the construction of the 110,000-volt substation at the steam power plant of the Columbus Electric & Power Company at First Avenue and Eighteenth Street, to cost about $180,000.

MIAMI, FLA.—Plans are under way by the Florida Power & Light Company, recently organized, to erect two transmission lines from Miami, one to supply electricity to Golden Beach and Fulford, and the other to Hialeah. At Hialeah the company will also furnish electricity to operate the wells of the Miami municipal water plant.

ST. AUGUSTINE, FLA.—The St. Johns Electric Company is planning to erect a 33,000-volt transmission line from its local plant through Hastings to Palatka and outlying districts.

SARASOTA, FLA.—Bonds to the amount of $125,000 have been sold for the construction of a new municipal electric plant.

ERIN, TENN.—The Erin Utilities Company plans to erect a 2,300-volt transmission line to Cumberland City within the next eighteen months. L. F. Stone is president.

BROOKHAVEN, MISS.—The City Council is considering a bond issue of $50,000 for improvements to the municipal light and water plant.

CHENEYVILLE, LA. — The Council is considering the installation of an electric light power plant in conjunction with a waterworks system. F. P. Joseph, Glenmore, La., is consulting engineer.

STERLINGTON, LA.—Plans are under way, it is reported, by H. C. Couch, Pine Bluff, Ark., and associates for the construction of a large electric power plant at Sterlington, just above the Ouachita locks and dams. Plans include the erection of high-tension lines from Sterlington within a radius of 100 miles, connecting with other transmission lines operated by the company in Arkansas and Mississippi. The proposed plant will use natural gas for fuel. The cost is estimated at about $2,500,000. Sterlington has not a post office.

ERICK, OKLA.—Extensions to the municipal electric power plant, including the installations of an oil engine direct-connected to generator of about 300 hp. capacity, etc., are under consideration. J. A. Richardson is manager.

ROOSEVELT, OKLA. — The Roosevelt Light & Power Company is considering the erection of a high-tension transmission line within the next few months.

CHILDRESS, TEX.—The Childress Electric & Ice Company, it is reported, contemplates asking for bids about Sept. 1 for the construction of a new power plant, to cost about $100,000.

FORT WORTH, TEX.—The Southwestern Power & Light Company has issued $2,000,000 in capital stock, part of the proceeds to be used for extensions and improvements to its system.

FORT WORTH, TEX.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 5, for generators, with switchboard, for the local naval station (Schedule 2469); also for two induction motors and two starting compensators. (Schedule 2471).

HARLINGEN, TEX.—The Valley Electric & Ice Company plans extensions in its ice-manufacturing plant, power lines, etc., to cost about $100,000. Electrically operated equipment will be installed in the ice plant.

LITTLEFIELD, TEX.—R. E. McCaskell, Electra, and associates contemplate establishing an electric light plant in Littlefield.

SANDERSON, TEX.—The Sanderson Light, Water & Ice Company will install a 165-hp. Anderson oil engine and full electric unit. Equipment has already been purchased. Joe Kerr is president.

TREZEVANT, TEX.—The City Council is considering the installation of an electric light and power plant, to cost about $40,000.

Pacific and Mountain States

PE ELL, WASH.—Plans are under consideration by the Pe Ell Light & Power Company for remodeling its plant.

SEATTLE, WASH.—The Puget Sound Power & Light Company has been granted a permit by the State Supervisor of Hydraulics to appropriate water on the Baker River in Skagit County for a hydro-electric plant to develop 65,000 hp. The cost is estimated at $3,500,000. It will include a dam 235 ft. high, 325 ft. long on top and 100 ft. long at bottom.

SOUTH BEND, WASH.—The Willapa Power Company contemplates installing a 200-hp. Fairbanks Morse semi-Diesel engine in its local plant, to be used as an auxiliary. The cost of the proposed extension is estimated at about $20,000.

BANDON, ORE.—The City Council has entered into a contract with the Mountain States Power Company, Albany, to supply power to operate the municipal electric system. The company will erect a 22,000-volt transmission line from Beaver Hill to the city limits. The municipal plant will be closed down.

BEND, ORE.—The Council is considering the installation of an ornamental lighting system in the business district, to cost about $15,500.

GLENDALE, CAL.—The Council is considering calling an election to submit to the voters the proposal to issue $300,000 in bonds to construct an auxiliary power plant for the municipal electric system.

LIVERMORE, CAL. — Extensions and improvements to its local system, to cost about $83,600, are under consideration by the Pacific Gas & Electric Company. The work includes the installation of four 1,000-kva. transformers.

LONG BEACH, CAL.—The City Council has preliminary plans for the installation of an ornamental lighting system on Broadway, from Ocean Park to Alamitos Avenue.

LOS ANGELES, CAL.—Petitions requesting the City Council to submit to the voters at the election to be held Aug. 26 a bond issue of $26,000,000 for extensions and improvements to the municipal electric light system are being circulated.

LOS ANGELES, CAL.—The Bethelehem Shipbuilding Corporation plans to install electric power equipment in connection with proposed extensions at its shipyard, Terminal Island, to cost about $1,000,000.

LOS ANGELES.—The City Council will soon ask bids for the installation of ornamental lamps on Alvarado Street consisting of 102 pressed-steel standards; First Street, 65 standards; Grand Avenue, 65 standards and Cahuenga Avenue, 84 standards.

NAPA, CAL.—The City Council plans to install an ornamental lighting system in the business section, comprising about 150 standards, to cost about $31,000. H. A. Harrold is city engineer.

PLACERVILLE, CAL.—The El Dorado Power Company, a subsidiary of the Western Gas & Electric Company has applied to the Federal Power Commission for preliminary permit for a hydro-electric project in El Dorado County to develop 24,100 hp. The company proposes to divert water from Silver Creek, tributary of the American River, and to build a power house above Kyburz. The cost is estimated at $3,659,000.

SAN BERNARDINO, CAL.—The Council has rejected all bids received for the installation of an ornamental lighting system on Fifth Street, from D to I Streets, and will ask for new bids at an early date.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company contemplates the construction of a hydro-electric plant at Bruce's Eddy, on the North Fork of Clearwater River, where it proposes to develop about 40,000 hp.

STITES, IDAHO.—The Kooskia Milling & Power Company has been instructed by the Public Utilities Commission to make improvements to its electric generating plant to enable it to give adequate electrical service in Stites.

COLORADO SPRINGS, COL.—Arrangements are being made for the construction of a municipal steam-power plant, to cost between $380,000 and $460,000, depending whether it will be of 2,500 kw. or 5,000 kw. capacity. This unit will be built whether the city takes over the entire electrical system of the Colorado Springs Light, Heat, & Power Company or not. Wood & Weber, Denver, are engineers.

Canada

MACLEOD, ALTA.—Plans are under consideration for rebuilding the overhead electrical distribution system.

CHATHAM, ONT.—Extension to the transmission line of the Hydro-Electric Power Commission of Ontario at Government Park is under consideration.

TETREAUVILLE, QUE.—Work will soon begin on the construction of a hydro-electric development at Tetreauville, a few miles from Ottawa, by the Ottawa River Power Company, to cost about $300,000. The company also plans to build a steam auxiliary plant and substation to generate electricity for local distribution.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 1, 1924)

1,499,403. ELECTRICAL CONDENSER; W. H. Priess, Belmont, Mass. App. filed Dec. 5, 1921. Adapted for use to interconnect a low loss high-powered radio frequency reservoir circuit and an antenna circuit tuned to the same period.

1,499,404. ELECTRICAL CONDENSER; W. H. Preiss, Belmont, Mass. App. filed Dec. 5, 1921. For use as a series antenna condenser, etc.

1,499,409. ELECTRIC HEATING ELEMENT; O. Schaumberg, Pittsburgh, Pa. App. filed Nov. 1, 1922. Continuous-wound.

1,499,411. MEANS FOR CARRYING OFF HEAT GENERATED IN ELECTRICAL APPARATUS; G. Schroeder, Hale, England. App. filed March 11, 1921. By means of liquid flowing through ducts in the core which are disposed across the path of movement of the lines of flux in alternating current machines.

1,499,414. ELECTROLYTE FOR ELECTROLYTIC CELLS; J. Slepian, Swissvale, Pa. App. filed Nov. 20, 1920. Combining the desirable characteristics of both phosphates and borates.

1,499,423. SYSTEM OF VENTILATION AND OPERATING MEANS THEREFOR; W. Sykes, Wilkinsburg, Pa. App. filed Nov. 20, 1919. For preventing the occurrence of excessive temperatures in dynamo-electric machines.

1,499,434. TUBING HEAD HEATER; J. C. Woodson, Mansfield, O. App. filed Nov. 16, 1921. For the die blocks of tubing machines.

1,499,438. SYSTEM OF COMMUNICATION WITH MOVING VEHICLES; H. A. Affel, Brooklyn, N. Y. App. filed June 18, 1921.

1,499,447. MACHINE FOR CASTING LEAD SEALS; O. G. Cook, Columbus, O. App. filed Jan. 22, 1923. Used for sealing electric and gas meters, etc.

1,499,464. TRANSMISSION REGULATING CIRCUITS; O. H. Loynes, Woodridge, N. J. App. filed Jan. 26, 1921. Signaling circuits.

1,499,476. MEANS INDICATING AVERAGE RATE FLOW OF ENERGY; G. E. Quinan, Seattle, Wash. App. filed Aug. 5, 1918. To determine the maximum average amount of electrical energy required for satisfying the maximum average demand of a consumer during any given period of time, etc.

1,499,502. ELECTRIC GRATE; J. H. Carmean, Kansas City, Mo. App. filed Nov. 30, 1923. Imitation coal type.

1,499,542. POWER SYSTEM; C. Macmillan, Schenectady, N. Y. App. filed May 11, 1923. Of electric ship propulsion.

1,499,548. TROLLEY HARP AND MEANS FOR EFFECTIVELY OPERATING THE SAME; H. Ramelow, Springfield, Ill. App. filed Nov. 12, 1923.

1,499,551. ALTERNATING CURRENT SYSTEM; F. Rieber, Berkeley, Cal. App. filed Sept. 26, 1921. In which it is necessary that the current supplied be maintained very nearly constant at any one of a number of optional values.

1,499,586. HEATING DEVICE FOR EXPLOSION MOTORS; J. J. P. Marcé, Paris, France. App. filed Dec. 8, 1921. Electric resistance heater.

1,499,591. HANDLAMP; A. P. Paine, New Haven, Conn. App. filed June 9, 1920. Flashlight.

1,499,600. MAKING COLLOIDAL SUSPENSIONS; C. S. Smith, Brooklyn, N. Y. App. filed April 5, 1922. Filtering tank for the conversion of suspended matter in water to a colloidal state.

1,499,615. ELECTRICAL HEAT TREATMENT OF MATERIAL; T. A. F. Holmgren, Stockholm, Sweden. App. filed Oct. 19, 1921.

1,499,616. HEATING APPARATUS; A. E. Johnson, Beverly, Mass. App. filed Oct. 12, 1920. For heating or conditioning coated canvas or similar reinforcing fabric.

1,499,622. DISK COMMUTATOR FOR ELECTRIC MOTORS AND DYNAMOS; H. Markwalder, Wurenlos, Switzerland. App. filed July 23, 1923.

1,499,645. ELECTRIC WELDING; S. Dyhr, Berlin-Charlottenburg, Germany. App. filed Aug. 26, 1921. Resistance principle adapted for welding a plurality of seams in one piece of work.

1,499,646. TELEGRAPHY; A. Ebeling, Berlin-Schoneberg, Germany. App. filed Aug. 24, 1921. Method for reducing the inductive effect of telegraphing currents.

1,499,693. ELECTRICAL-HEATER RESISTANCE ELEMENT; R. W. Reynolds, Darlinghurst, near Sydney, New South Wales. App. filed Jan. 17, 1923. Constituted of a film of a paint-like substance which is applied to a support.

1,499,695. ELECTRIC MACHINE; R. Rüdenberg, Berlin-Charlottenburg, Germany. App. filed June 1, 1921. Conductors arranged to prevent the formation of eddy currents.

1,499,696. COOLING ELECTRIC MACHINERY; R. Rüdenberg, Berlin-Grunewald, Germany. App. filed June 21, 1921. Air ventilation.

1,499,704. BATTERY BOX; G. C. Stebbins, Ashtabula, O. App. filed Aug. 24, 1922. With arrangement for sealing the cover in place.

1,499,746. ELECTRIC IRON; D. Michie, Irwin, Pa. App. filed Dec. 15, 1922.

1,499,750. PROCESS OF PRODUCING GAS; J. H. Reid, Readsboro, Vt. App. filed Feb. 13, 1920. In the manufacture of calcium carbide.

1,499,757. ELECTRIC TOASTER AND HEATER; A Wyzenbeek, Chicago, Ill. App. filed April 6, 1923. Rectangular disk stove.

1,499,765. SPEED CONTROLLING APPARATUS FOR AUTOMOBILES AND THE LIKE; J. K. B. Falck, Larvik, Norway. App. filed Aug. 2, 1922.

1,499,766. SWITCHING SYSTEM; J. C. Field, Orange, N. J. App. filed July 5, 1919. For detecting the presence of submarine or other marine vessels.

1,499,770. ELECTRIC ARC WELDING; E. Gruenfeldt, Cleveland, O. App. filed Sept. 1, 1921. For joining sheet metal parts.

1,499,788. SCREW PLUG FLUSH RECEPTACLE; I. R. Seltzer, Waterbury, Conn. App. filed June 21, 1920.

1,499,853. MULTISPEED DYNAMO ELECTRIC MACHINE; F. Creedy, Yorkshire, England. App. filed Feb. 17, 1920. Alternating current induction motors of variable pole number.

1,499,863. SEPARATOR FOR STORAGE BATTERIES; F. W. Frahm, Los Angeles, Cal. App. filed Dec. 1, 1922. Comprising rubber, asbestos and sawdust.

1,499,865. HIGH-SPEED SIGNALLING SYSTEM; Henry E. Halborg, Washington, D. C. App. filed Sept. 1, 1923. Multikey telegraph system.

1,499,871. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed May 24, 1921.

1,499,888. DIRECTION INDICATOR; D. B. Spatz, Reading, Pa. App. filed Dec. 4, 1922. For use on vehicles.

1,499,901. STORAGE BATTERY CELL; R. J. Anderson, Minneapolis, Minn. App. filed June 5, 1922. Lead type.

1,499,907. STORAGE BATTERY; S. H. Brown, Cleveland, O., App. filed Aug. 28, 1922. Rectifier incorporated with battery for charging.

1,499,918. COMBINED PHASE CONVERTER AND FREQUENCY CHANGER; C. LeG. Fortescue, Pittsburgh, Pa. App. filed Feb. 5, 1921. Adapted for accelerating induction motors.

1,499,922. ELECTRIC ARC FURNACE; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Dec. 10, 1921. Employing electrodes arranged to form an arc in proximity to a quantity of metal to be heat treated.

1,499,931. INDUCTION OR IGNITION COIL; E. B. Jacobson, Pittsfield, Mass. App. filed April 15, 1922. For use with internal combustion engine.

1,499,979. TUNING DEVICE FOR WIRELESS RECEIVING CIRCUITS; C. M. Gray, Del Mar, Cal. App. filed Aug. 15, 1921.

1,500,003. ARRANGEMENT FOR LOCALIZING DISTURBED AREAS IN ELECTRIC MAINS; P. Schade, Hermsdorf, Germany. App. filed May 3, 1922.

1,500,027. BATTERY; A. Morch, Brooklyn, N. Y. App. filed June 9, 1922. Galvanic cell.

1,500,034. SYSTEM AND DEVICE FOR BATTERY CHARGING; W. T. Powell, Rochester, N. Y. App. filed May 28, 1923. Device for automatically controlling the regulation of a rectifying device which functions intermittently to transform alternating current into direct current.

1,500,076. BATTERY PLATE AND PROCESS OF MAKING SAME; W. E. Holland, Philadelphia, Pa. App. filed Feb. 1, 1922.

1,500,080. PROCESS AND DEVICE FOR PREPARING ALCOHOLS AND ALDEHYDES FROM HYDROCARBONS; C. A. Kloopenburg, Tjepoe, Dutch East Indies. App. filed July 26, 1922.

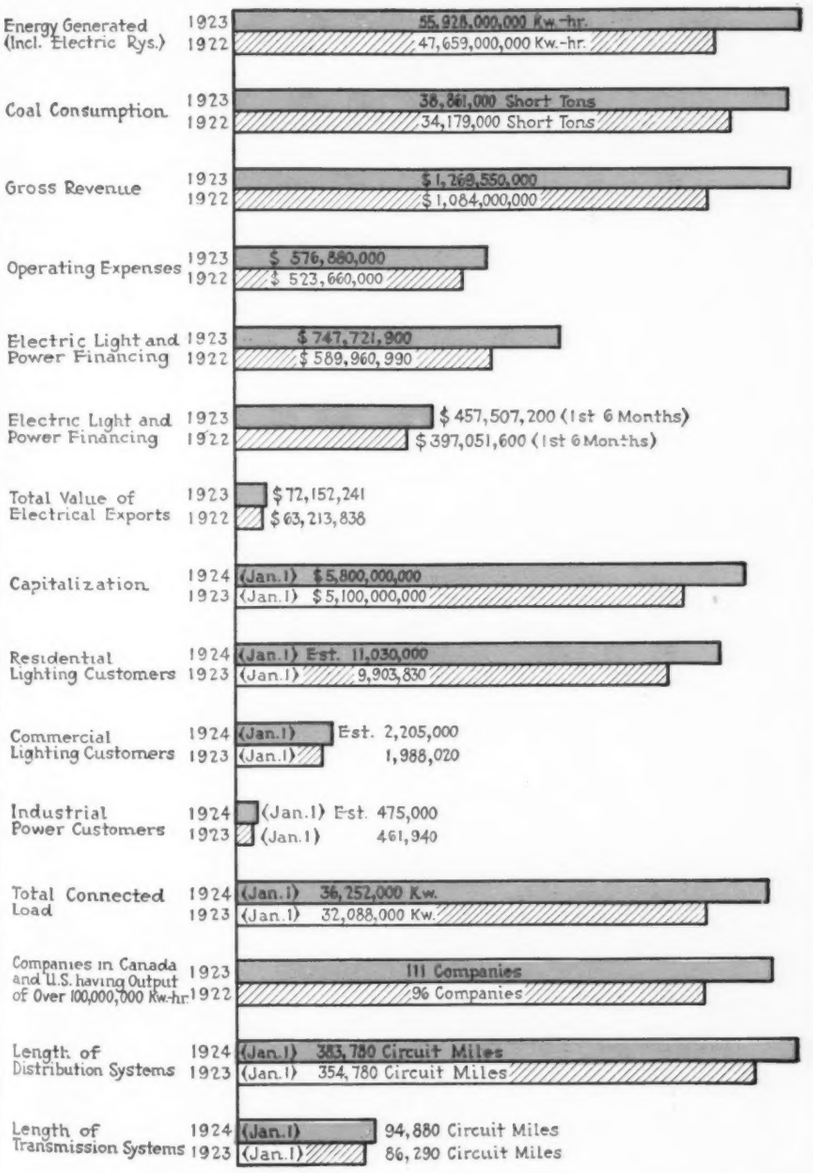
1,500,082. ELECTRIC CURRENT REGULATOR; W. Langdon-Davies and A. Soames, London, England. App. filed Feb. 27, 1922. Inductive type for use in alternating current circuits.

1,500,086. MANUFACTURE OF CHENILLE PRELIMINARY FABRICS; G. Liebender, Oelsnitz, Germany. App. filed Feb. 14, 1922. As required for the production of Axminster-carpets.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

High Lights on the Central-Station Industry


Energy Generated (Incl. Electric Rys.) 1923 55,928,000,000 Kw.-hr.
1922 47,659,000,000 Kw.-hr.
Coal Consumption 1923 38,861,000 Short Tons
1922 34,179,000 Short Tons
Gross Revenue 1923 $1,269,550,000
1922 $1,084,000,000
Operating Expenses 1923 $ 576,880,000
1922 $ 523,660,000
Electric Light and Power Financing 1923 $ 747,721,900
1922 $ 589,960,990
Electric Light and Power Financing 1923 $ 457,507,200 (1st 6 Months)
1922 $ 397,051,600 (1st 6 Months)
Total Value of Electrical Exports 1923 $72,152,241
1922 $63,213,838
Capitalization 1924 (Jan. 1) $5,800,000,000
1923 (Jan. 1) $5,100,000,000
Residential Lighting Customers 1924 (Jan. 1) Est. 11,030,000
1923 (Jan. 1) 9,903,830
Commercial Lighting Customers 1924 (Jan. 1) Est. 2,205,000
1923 (Jan. 1) 1,988,020
Industrial Power Customers 1924 (Jan. 1) Est. 475,000
1923 (Jan. 1) 461,940
Total Connected Load 1924 (Jan. 1) 36,252,000 Kw.
1923 (Jan. 1) 32,088,000 Kw.
Companies in Canada and U.S. having Output of Over 100,000,000 Kw-hr 1923 111 Companies
1922 96 Companies
Length of Distribution Systems 1924 (Jan. 1) 383,780 Circuit Miles
1923 (Jan. 1) 354,780 Circuit Miles
Length of Transmission Systems 1924 (Jan. 1) 94,880 Circuit Miles
1923 (Jan. 1) 86,290 Circuit Miles

NOTE

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

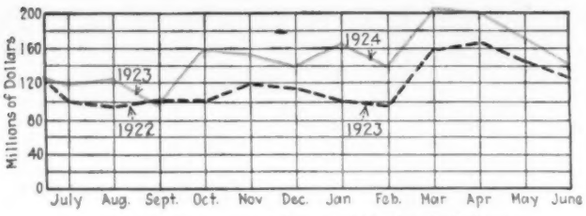
The Future Based on the Past

THE electrical industry is typically an industry of growth—of growth not only in energy generated and revenue received, but of growth in efficiency of operation, in scientific development and in its general service to humanity. Facts which were true last year are not true today, and facts which are true today would give a distorted picture of the industry if applied directly to the coming years.

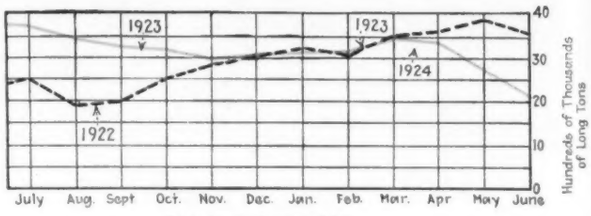
But much can be gained by a study of past development, especially if such development is studied in relation to the economic facts underlying it. It is only within the last few years that the fundamental statistics of the industry have been made available in such form as to provide a basis for study and prognostication into the future. It is true that the government has taken a census of the electric light and power industry every five years since 1902, but by the time the final data are issued the industry has grown to such an extent as to take away a large part of the data's value. The final data on the census of 1922 have not been issued as yet; when they are they must be used with caution, since 1922 was not a normal year in so far as the electrical industry was concerned. Under the direction of Secretary Hoover the annual operations of the manufacturing branch of the electrical industry will be available every two years, the results of the census being made public within a year after being taken. This is a large step in the direction of increased value of electrical statistics.

The gathering of statistics for a growing industry such as this is a stupendous and costly undertaking, requiring constant investigation and a considerable staff. A short column of figures on some activity of the industry may easily represent weeks and even months of work. With most of the old industries the growth is fairly regular and the industries are largely concentrated into certain industrial centers. But the electric light and power industry extends from the Atlantic to the Pacific, and from the Lakes to the Gulf. There are 3,073 central stations in the country with a rating of under 500 kva. and 1,302 companies under 100 kva. Such a wide distribution of activities and so many small companies make the collection of data doubly difficult. The one redeeming feature is that less than 2 per cent of the total number of generating companies operate 63 per cent of the generator rating of the company, so that reports received regularly from these larger companies give a very accurate basis for arriving at the activities of the industry as a whole.

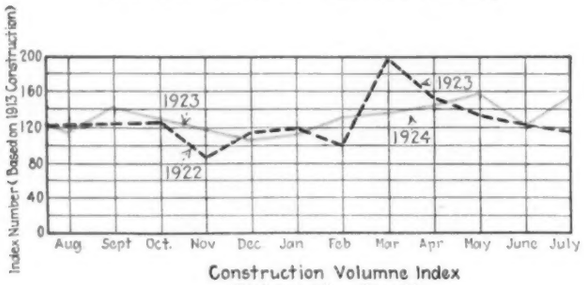
How the Primary Industries Are Trending



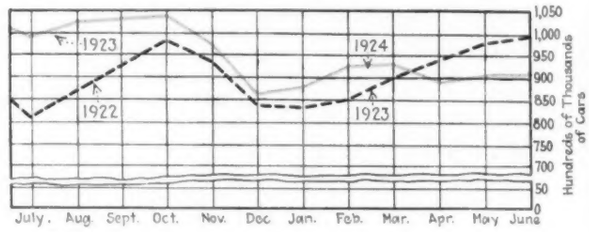
Contracts Awarded for Residential Buildings



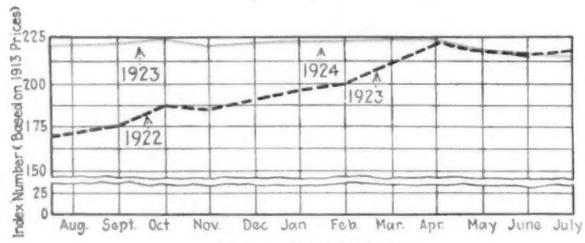
Pig-Iron Production



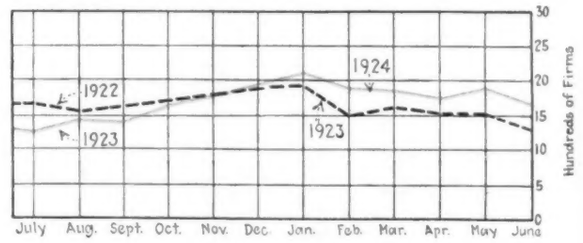
Construction Volume Index
(Engineering-News Record)



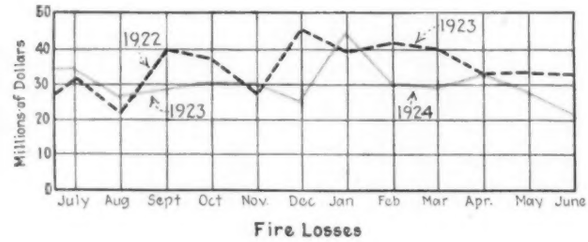
Total Average Weekly Freight-Car Loadings



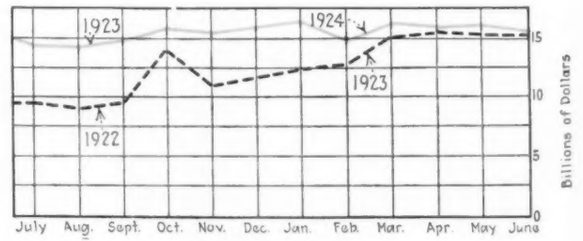
Construction Cost Index
(Engineering-News Record)



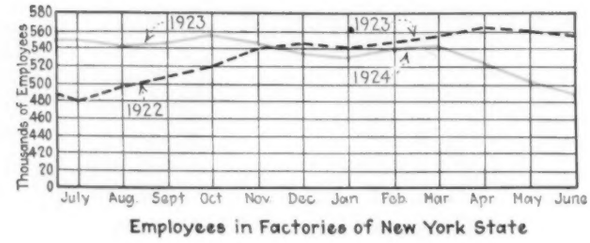
Business Failures



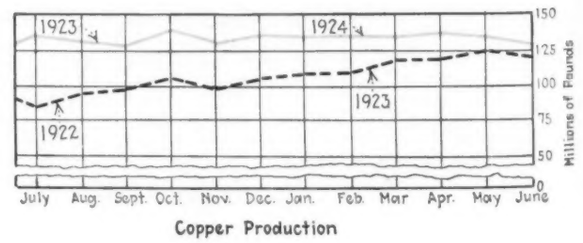
Fire Losses



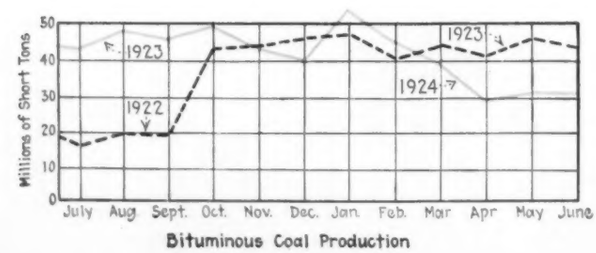
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Business Conditions Turn for the Better

INDUSTRY in general has continued on a declining scale of operations, recession being general and rapid through June. In so far as the electrical industry is concerned, however, the bottom seems to have been reached, July marking a distinct improvement throughout the industry.